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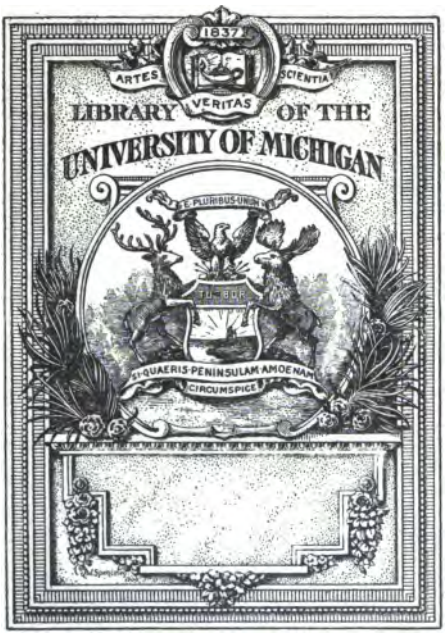
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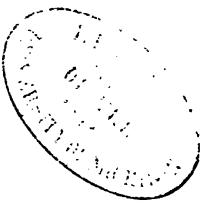

SIR W.M HERSCHELL.

PETER THE GREAT.

BURKE.

SIR H. DAVY.

THE

PURSUIT OF KNOWLEDGE

UNDER DIFFICULTIES.

By J. L. Craik & C. Knight

ILLUSTRATED BY ANECDOTES.

With Portraits.

REVISED EDITION,

WITH A PREFACE AND NOTES,

BY

FRANCIS WAYLAND, D.D.,
PRESIDENT OF BROWN UNIVERSITY.

IN TWO VOLUMES.

VOL. II.

NEW YORK:
HARPER & BROTHERS, PUBLISHERS,
82 CLIFF STREET.
1847.

Entered according to Act of Congress, in the year 1840, by
MARSH, CAPEN, LYON, AND WEBB,
in the Clerk's Office of the District Court of Massachusetts.

09-10-28 BF

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THE

PURSUIT OF KNOWLEDGE

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CHAPTER I.

Introduction.—Amusement in the Pursuit of Knowledge. Pursuit of Knowledge by Persons of Rank or Wealth: —Crates; Thales; Democritus; Anaxagoras; Pythagoras; Alfieri; Nicephorus Alphery; Marcus Aurelius; Julian; Charlemagne; Alfred; James I., of Scotland; Henry I.; Charles V.; Henry VIII.; Edward VI.; Elizabeth; James I., of England; Alphonso X.

We remarked at the close of the preceding volume, that the moral habits, which the Pursuit of Knowledge has a tendency to create and foster, form one of its chief recommendations. Knowledge is, essentially and directly, power; but it is, also, indirectly, virtue. And this it is, in two ways. It can hardly be acquired, without the exertion of several moral qualities of high value; and, having been acquired, it nurtures tastes, and supplies sources of enjoyment, admirably adapted to withdraw the mind from unprofitable and corrupting pleasures. Some distinguished scholars, no doubt, have been bad men; but we do not know how much worse they might have been, but for their love of learning, which, to the extent it did operate upon their characters, could not have been

otherwise than beneficial. A genuine relish for intellectual enjoyments, is naturally as inconsistent with a devotion to the coarser gratifications of sense, as the habit of assiduous study is with that dissipation of time, of thought, and of faculty, which a life of vicious pleasure implies.

But knowledge is also happiness, as well as power and virtue; happiness both in the acquisition, and in the possession. And were the pursuit of it nothing better than a mere amusement, it would deserve the preference over all other amusements, on many accounts. Of these, indeed, the chief is, that it must, almost of necessity, become something better than an amusement,—must invigorate the mind, as well as entertain it; and refine and elevate the character, while it gives to listlessness and weariness their most agreeable excitement and relaxation. But, omitting this consideration, it is still, of all amusements, the best, for other reasons. So far from losing any part of its zest with time, the longer it is known, the better is it loved. There is no other pastime, that can be compared with it, in variety. Even to him who has been longest conversant with it, it has still as much novelty to offer, as at first. It may be resorted to by all, in all circumstances; by both sexes; by the young and the old; in town or in the country; by him who has only his stolen half hour to give to it, and by him who can allow it nearly his whole day, in company with others, or in solitude, which it converts into the most delightful society. Above all, it is the cheapest of all amusements, and consequently the most universally accessible. Causes, which will suggest themselves to the reflection of every reader, and which, therefore, we need not here stop to explain, have hitherto, in a great measure, excluded our laboring population from the enjoyments of science and literature; but this state of things is passing away, and the habit of reading is extending itself, rapidly, even among the humblest ranks. Nothing can be more natural than this. A book is emphatically the poor man's luxury; for it is of all luxuries that which can be obtained at the least cost. By means of district libraries, almost every individual of the population might be enabled to secure

access for himself to an inexhaustible store of intellectual amusement and instruction, at an expense which even the poorest would scarcely feel. As yet, these advantages have been in the possession of a few individuals, comparatively speaking, to whom they have been a source not more of enjoyment than of intelligence and influence.

Among the highest orders of society, the very cheapness of literary pleasures has probably had the effect of making them to be less in fashion than others of which wealth can command a more exclusive enjoyment. Even such distinction, as eminence in intellectual pursuits can confer, must be shared with many of obscure birth and low station; and, on that account, alone, has doubtless seemed often the less worthy of ambition, to those who were already raised above the crowd, by the accidents of fortune. Yet, whatever enjoyment there may really be in such pursuits, will not, of course, be the less to any one, because he happens to be a person of wealth or rank. On the contrary, these advantages are, perhaps, on no other account more valuable, than for the power which they give their possessor of prosecuting the work of mental cultivation to a greater extent than others. He has, if he chooses, a degree of leisure and freedom from interruption, greatly exceeding what the generality of men enjoy. Others, have seldom more than the mere fragments of the day to give to study, after the bulk of it has been consumed in procuring merely the bread that perisheth; he, may make literature and philosophy the vocation of his life. To be enabled to do this, or to do it only in small part, many have willingly embraced comparative poverty, in preference to riches. Among the philosophers of the ancient world, some are said to have spontaneously disencumbered themselves of their inheritances, that the cares of managing their property might not interrupt their philosophic pursuits. Crates, Thales, Democritus, Anaxagoras, are particularly mentioned, as having made this sacrifice. But in those days, it is to be remembered, knowledge was only to be obtained by travelling into foreign countries, and those who sought it, were therefore obliged, before setting out on the search,

either to relinquish altogether the possessions they had at home, or to leave them in charge of trustees, who generally took advantage of their stewardship, to embezzle or squander them. Doubtless, no one of the celebrated persons we have enumerated, would have thrown away his patrimony, if he could have retained it, with as little inconvenience as such an encumbrance can possibly occasion a philosopher in our own times. The only worldly imprudence, even, of which they can be fairly accused, is, that of having preferred knowledge to wealth, when it was necessary to make a choice between the two; or that of having allowed themselves to be too easily cheated of the latter, in their enthusiastic devotion to the former. Bayle, who had himself a strong sympathy with this love of a quiet, in preference to a splendid life, states the matter correctly, in the case of Democritus, when he says, in his article on that great father of natural philosophy, "The spirit of a great traveller reigned in him; he journeyed to the heart of India, in quest of the riches of learning, and bestowed but little thought on those other treasures which he had almost at his door." Anaxagoras, in like manner, although he did not travel so far from home, as Democritus, still owed the loss of his property to his being obliged to leave it in the hands of others. This ingenious, but somewhat fanciful speculator, the master of Socrates and Euripides, and the honored friend of Pericles, was a native of Clazomenæ, in Ionia, and the descendant of noble and wealthy ancestors, whose lands he inherited. But, determining to devote his life to philosophy, he did not hesitate, when only about twenty years of age, to bid adieu to his fair possessions, and, crossing the Ægean, to repair to Athens, where he continued to pursue his studies, while his estate was running to waste, and at last maintained himself by giving lessons to others. Cicero mentions Anaxagoras, along with Pythagoras and Democritus, as having declined those public honors, and that share in the management of affairs, to which his birth and qualities entitled him to aspire, "for the sake," as he expresses it, "of tranquillity, and for the sake of the sweetness of knowledge, than

which nothing is to man more delightful."* This is the testimony of one who had himself tasted the charms of political power as well as those of philosophy.†

We may here notice the singular story of NICEPHORUS ALPHERY, as related in the Biographia Britannica. Alphery was born in Russia, about the close of the sixteenth century, of the family of the Czars. He was, we suppose, of the ancient race of Ruric, which, after occupying the throne, for nearly eight centuries, gave place to a new dynasty on the death of Feodore Iwanovitch, commonly called Feodore I., in 1598. This event, which was immediately followed by the usurpation of Boris Godunow, after he had caused Feodore's only brother Demetrius, the heir to the crown, to be assasinated, was the occasion of protracted troubles to Russia. It appears to have been about the commencement of these convulsions, that Alphery and his two brothers were sent by their friends, for safety, to England, and intrusted to the care of a merchant, connected by commercial relations with their native country. Their protector gave them a liberal education, and, at the proper age, they were all entered of the University of Oxford. Soon after this, however, two of them were attacked by small pox, and died. Nicephorus, the survivor, now resolved to take orders in the English Church; and, accordingly, having been ordained, he was appointed, in 1618, to the living of Wooley, in Huntingdonshire, the income of which was barely sufficient to afford him a maintenance. By this time, the throne of his ancestors was in the possession of Michael Fedrowitch Romanow, who was the son of a patriarch of the Greek Church, and had, in 1613, when only sixteen years of age, obtained the imperial crown, which has ever since been worn by his descendants. Thus, while on the one hand, the Church had received into her ranks the heir of an empire, that empire, on the other hand, received a sovereign from the Church. The disturbances that had so long distracted

* De Oratore, lib. iii.

† In modern times, Alfieri, the great Italian dramatist, gave up his estate to his sister, in order not to be distracted, by the management of it, from his poetical studies.

Russia, however, were not settled by the accession of Michael; and it is asserted, that, subsequently to this period, Nicephorus was actually twice invited to return to his native country, and put himself at the head of a powerful party who desired to place him on the throne. But, with a want of ambition which many will despise, although its wisdom might perhaps be defended, he preferred, on both occasions, his humble parsonage, to this splendid temptation. Never having obtained any additional preferment, he long made himself happy by the discharge of his duties, in the lowly condition he had embraced; and his meek spirit was probably but rarely troubled even by a thought of the exalted station to which he once might have attained. After settling at Wooley, he married, and had a family. Alphery was not destined, however, even by his relinquishment of the rights of his birth, to escape the storms of political commotion; for, on the ascendancy of the republican party after the civil wars, he was deprived of his living, and, with his wife and children, compelled to wander about, for some time, without a home; nor did he recover his benefice till the Restoration. By this time, the infirmities of advanced age had left him but little strength for the performance of his wonted duties; and, leaving his parish in charge of a curate, he soon after retired to Hammersmith, to the house of one of his sons, who was settled there. In this retirement, he lived for some years, unnoticed, but not unhappy; and when his death took place, at last, his singular fortunes had been so much forgotten by all the world, that nobody has recorded the date of the event.

We read nothing of any remarkable acquirements in literature made by this individual; but, if moderation of desires be a quality of the philosophic spirit, he is entitled to be regarded as no ordinary philosopher. Many others, however, might be enumerated, who, even on a throne, have cultivated science and letters, and intermingled the occupations of study with those of sovereignty. We may mention, among the Roman emperors, the excellent MARCUS AURELIUS, a prince, who, with some failings, manifested many virtues that have rarely adorned,

in the same degree, either a public or a private station. Called to the imperial dignity, contrary to his own wishes, Aurelius, who had been a philosopher before his exaltation, remained the same in character, and, as far as possible, in habits, after he became the master of the world; and he is, at least, one instance of a naturally good disposition, which power the most unbounded was unable to corrupt. To our common notions, or prejudices, his giving his attendance, when nearly sixty years of age, to a course of philosophical lectures, may seem to savor something of pedantic display: but kings have often been worse employed; and it is, at any rate, delightful, to find this good and enlightened emperor, after his victorious campaigns, repairing, ere he returned home to receive the congratulations of his impatient Romans, to the mother-city of philosophy, learning, art, and freedom, the subjugated, but still illustrious Athens; and there examining the trophies of her old glory, mixing in her religious processions and ceremonies, rebuilding and reendowing her schools, bestowing new honors and privileges on the teachers, and neglecting nothing that could make her once more the metropolis of the world of letters. Marcus Aurelius is said to have written several books; but only one work, his 'Moral Reflections,' composed in Greek, has come down to us. How happy would nations be, this prince was wont to exclaim, in the words of Plato, if the philosophers were their kings, or their kings were philosophers. And he offered in himself, equally able as was his administration of affairs at home and abroad, in peace and in war, at least one splendid exemplification of the truth of his favorite remark—which yet might not be found to hold generally good, unless philosophy were to include, as it did in him, practice as well as speculation.

The emperor JULIAN, in a later age, though, perhaps, surpassing Marcus Aurelius in literary talents and accomplishments, and endowed also with many great qualities by Nature, does not exhibit to us quite so beautiful a picture of philosophy on a throne. He had neither the simplicity, sincerity, and perfect truthfulness of his pre-

decessor's moral character, nor the unimpassioned sagacity and clearness of vision which distinguished his understanding; and is chargeable indeed with acting in many respects in a spirit of affectation and blind prejudice, any thing but creditable to a philosopher. Yet, during his short reign of little more than a year and a half, Julian proved himself both an able monarch and a man possessed of great virtues. In war, his valor was only equalled by his clemency. An enemy to all luxury and excess, he did every thing in his power, by his authority and his example, to repress the growing extravagances and debaucheries of the times, and abolished many customs of the imperial court, which he considered only occasions of expense and effeminate indulgence. Much of his time was spent in conversing with learned men, much in solitary study; indeed, from a very early hour in the night till morning, was generally devoted by him, even during his campaigns, to reading and writing. He has left several works, all written in Greek, which was then the language of the court.

In a still more recent, but much darker, age, we find literature cultivated with zeal, by the emperor CHARLEMAGNE, when there were few other individuals, to whom it was at all an object of attention, throughout his vast dominions. This great conqueror, whose life was spent in almost incessant wars, was yet wont to give whatever leisure he could spare to reading, writing, and the converse of the learned; and a considerable number of letters, and other literary performances, are still extant, the production of his pen. Even when confined to bed, by sickness, he was accustomed to amuse himself, we are told by his biographer and contemporary, Eginhard, in attempting to imitate the elaborately ornamented characters common in the books of that age; a statement which has been erroneously interpreted as importing that all his progress in the art of writing consisted merely in these ineffectual essays. It can scarcely be doubted, from other circumstances, that he was familiar with this art. The greatest service, however, which Charlemagne rendered to learning, was his munificent patronage of its professors, and the readiness and zeal with which he lent

himself to various schemes for its restoration and diffusion. The University of Paris, as is well known, sprang from a seminary which he established in his palace, (hence called the Palatine school,) and in the institution of which his principal adviser and assistant was the able and accomplished Alcuin. This school was opened about the year 780, while its projector was yet in the very midst of his wars. While letters, long forgotten both in courts and general society, were thus enjoying the protection of Charlemagne in the West, the famous Haroun Al Raschid, (or the Just,) whose name, the Arabian Nights' Entertainments have made so familiar to every reader, and whose extensive dominions, entitled him to be regarded as Emperor of the East, was affording them equal encouragement, in that quarter of the globe. Haroun was himself, indeed, an excellent poet, and distinguished for his proficiency in various branches of learning. But at this time, the Moors were very considerably ahead of the nations of Christendom, in civilization and the knowledge of the arts. The two great potentates we have mentioned, between whom so large a portion of the earth was divided, are recorded to have corresponded with each other; and in the year 807, an ambassador from the Caliph arrived in France, bringing with him various presents for Charlemagne. Among these, was a clepsydra, or water-clock, which excited especial admiration, as a contrivance beyond any thing which ingenuity had yet invented in Europe. Another of Haroun's presents was a set of chess-men, some of which are still preserved in the Royal Library at Paris. Charlemagne reigned from the year 768 to 814, when he died at the age of seventy-one; and Haroun Al Raschid died at the age of forty-seven, in 809, after a reign of twenty-three years.

But ALFRED, of England, whose extraordinary attainments in learning, made in the latter portion of a short and very busy life, we have already briefly noticed,* sheds a much brighter glory, over the ninth century, than Charlemagne and the Caliph Haroun do, over the eighth. Alfred was born, in the year 849, succeeded to the crown,

* See vol. i. p. 66.

in 871, and his reign, extended to the close of the century. Even the unusual lateness of the period at which his acquaintance with books commenced, was but the least of the untoward circumstances with which this wonderful man had to contend, in his pursuit of knowledge. Born, as he was, the son of a king, how scanty were the means of education, of which he had it in his power to avail himself, compared with those which, in our happier days, are within the reach of the poorest peasant! In that age, it demanded the price of a goodly estate to purchase a book; and in England, especially, teachers were so scarce, that Alfred, so long as he continued merely a prince dependent upon his father or his elder brothers, actually seems to have been without the requisite resources to procure their services. Nothing, as his biographer, Asser, informs us, was a more frequent subject of regret with him, than that during the only time of his life when he had either health or leisure for study, he had thus been left utterly without the means of obtaining instruction. For, as soon almost as he had passed his boyhood, he was obliged to engage in active duty, as a soldier; and the incessant toils of a military life, in the course of which, he is recorded to have fought no fewer than fifty battles, as well as to have undergone a succession of hardships and sufferings, under which an ordinary mind would have broken down in despair, consumed not a few of the best of his succeeding years.

And, even after he succeeded to the throne, when we consider that, in addition to the extensive literary labors which he accomplished, he not only attended to his multifarious public duties with a punctuality that has never been surpassed, but, notwithstanding his harassing bodily ailments, signalized himself by his prowess and dexterity in every manly exercise, we may well ask, by what mysterious art did he find time for all this variety of occupation! The answer is, that he found time, by never losing it. Time is the only gift or commodity, of which every man who lives has just the same share. The passing day is exactly of the same dimensions to each of us, and by no contrivance, can any one of us

extend its duration by so much as a minute or a second. It is not like a sum of money, which we can employ in trade, or put out at interest, and thereby add to, or multiply, its amount. Its amount is unalterable. We cannot "make it breed;" we cannot even keep it by us. Whether we will or no, we must spend it; and all our power over it, therefore, consists in the manner in which it is spent. Part with it, we must; but we may give it either for something, or for nothing. Its mode of escaping from us, however, being very subtle and silent, we are exceedingly apt, because we do not feel it passing out of our hands, like so much told coin, to forget that we are parting with it, at all; and thus, from mere heedlessness, the precious possession is allowed to flow away, as if it were a thing of no value. The first and principal rule, therefore, in regard to the economizing and right employment of time, is to habituate ourselves to watch it.

Alfred knew this well; and we may here relate the method he adopted to measure the passing hours, in his want of those more artificial timepieces which we possess. Having made his chaplains, as Asser in his simple narrative informs us, procure the necessary quantity of wax, he ordered six candles to be prepared, each twelve inches long, which he had found would together burn for four and twenty hours. Having marked the inches on them, therefore, he ordered that they should be lighted in succession, and each three inches that were consumed, he considered as recording the flight of an hour. "But finding," continues the historian, "that the candles burned away more quickly at one time than at another, on account of the rushing violence of the winds, which sometimes would blow night and day without intermission, through the doors and windows, the numerous chinks in the walls, or the slender covering of the tents, he bethought him how he might prevent this inconvenience, and having contrived artfully and wisely, he ordered that a lantern should be fairly fashioned of wood and horn; for white horn, when scraped thin, allows the light to pass through even like glass. The candle, therefore, being placed in the lantern, thus wonderfully constructed, as we have said,

of wood and horn, was both protected from the wind, and shone during the night as luminously without as within." Every heart will acknowledge that there is something not a little interesting, and even touching, in these homely details, which paint to us, so graphically, the poor accommodations of every kind, in the midst of which Alfred had to pursue his studies, and the humble matters with which his great mind was often obliged to occupy itself in contriving the means of gratifying its noble aspirations. This illustrious man, indeed, seems almost to have lifted himself quite above the tyranny of circumstances; realizing, in the most disadvantageous, nearly all that could be expected or desired in the most favorable. The difficulties, with which he had to contend, in truth, formed the very soil, out of which no small portion of his greatness grew. Among kings, he is not only the Great, but the very greatest. If we look merely to his zeal and services, in behalf of literature, it is impossible to name any royal personage, that can be compared with him, either in classic antiquity or in modern times. A genuine love for letters, and a proficiency in them, in the possessor of a throne, is worthy of our admiration, in whatever age or country, the phenomenon may be recorded to have been witnessed; because it must always be considered as a striking example of a triumph over seductions that are generally, of all others, found the most difficult to resist, and have, accordingly, been of all others the most seldom resisted. But of the other learned kings, of whom we read in history, some were literary in a literary age; others, naturally unfitted for the more active duties of their station, took to philosophy, or pedantry, as a refuge from insignificance; some had caught the love and the habit of study before they had mounted a throne, or had dreamed of mounting one; above all, most, if not all of them, had been carefully educated and trained to letters in their youth. But it is told only of Alfred, that without an example to look to, without even the advantages of the very scantiest education, in an unlearned age, and a still more unlearned country, he, who had been only a soldier, from his youth, upwards, withdrew himself, of his own accord,

from the rude and merely sensual enjoyments of all his predecessors and all his contemporaries, to devote himself to intellectual pursuits, and to seek to interwine with the martial laurels that already bound his brow, the more honorable wreath of literary distinction.

Of the royal personages, who have distinguished themselves by their love and cultivation of letters, the most eminent, next to Alfred, is JAMES I., of Scotland, whose poem, entitled the 'King's Quhair,' composed by him during his imprisonment in Windsor Castle, we have already mentioned.* James was born in 1394, but having been taken prisoner, by the king of England, in 1405, was detained in that country, mostly in close confinement, till his thirtieth year; after which, having been allowed to return to Scotland, he reigned for thirteen years, and was at last cruelly assassinated in the Carthusian monastery, at Perth, on the 20th of February, 1437, by a faction of his nobles, whom his attempted reforms dissatisfied. Literature had been the principal solace of James's long imprisonment, and he brought with him, to the throne, the tastes which he had acquired in his exile. He certainly contributed very essentially, even during his short reign, to promote the civilization of his native country. Nothing can exceed the warmth of the admiration, with which all the old historians speak of his genius and accomplishments, and of the effect which his example had in diffusing among his people that spirit of literary cultivation, and love for all elegant and intellectual accomplishments, by which he was himself distinguished. He was a proficient, we are told, in the Latin language, and some authorities add, even in the Greek, although this last statement must be regarded as apocryphal, all things considered. His mastery over his native tongue, was, at all events, his most remarkable endowment. The songs and other metrical pieces, which he composed in the Scottish dialect, long continued to be the delight of all classes of his countrymen; and to their influence we are, in all probability, to trace much of that universal sensibility to poetry, which has ever since distinguished

* See vol. i. p. 216.

the Scottish peasantry, and which has displayed itself in the creation of a body of traditionary verse, of wonderful extent and richness. Give me, some one has said, the making of a people's ballads, and I care not who has the making of their laws. If the opinion, conveyed in this remark be correct, James I. perhaps influenced the character of his countrymen, quite as much, as any of their legislators.

Some authorities also claim for this prince, the honor of being the father of the music, as well as of the poetry, of his country. He is recorded by the old chroniclers to have been eminently skilled both in vocal and instrumental music, and to have performed on no less than eight different instruments, of which, the one, on which he most excelled, is stated to have been the harp. But it is certain, that from the time of James, we may date the birth of at least the literature of Scotland; to which, indeed, he seems to have also given not a little of the peculiar character that long distinguished it. His own writings, as has been stated, were poetical compositions, in the style that had been so recently introduced by Chaucer, whom, in his *Quhair*, he expressly mentions as his master. Those of them, that have come down to us, evince powers both of pathos and of humor of the very highest order, and such as no other Scottish poet, with the exception of Burns, can be considered as having equalled. Before his day, Fordun had written his prose chronicle of Scottish kings, and Barbour his metrical work, entitled, *The Bruce;* but these, notwithstanding some passages of vivid description in the latter, which certainly give its author considerable preeminence among the class to which he belongs, were merely such works as have been produced among every people having the use of letters as soon as they have acquired for themselves what may be called a history; and indicate not so much that a national literature has taken root among them, as simply that they have reached a certain antiquity, and have a past national existence to look back upon. That, which alone we can properly call the authorship of Scotland, commences with the works of King James, and is

continued by those of Dunbar, Gavin Douglas, and Sir David Lyndsay; who may all, in some sort, be considered as his imitators, or at least as having, like himself, taken their inspiration from that new-born poetry of England with which he, there can be little doubt, was the first to make his countrymen acquainted.

Few kings, therefore, in spite of the failure of many of his projected political reforms, have done more for their subjects than James did for his. He regenerated them by means more powerful than any merely political contrivances, when he exhibited before them, for the first time, the graces and attractions of intellectual cultivation, and gradually seduced them by the charm of his example to the love of the arts and elegances of civilized life. Laws and institutions are, after all, in themselves but the dead skeleton of society, and can only derive their life and efficiency from the spirit breathed into them by the character and moral condition of the people. They are the body; this is the animating soul. In giving, therefore, to his countrymen the first impulses of literary refinement, he gave them something better even than good laws, because it was that, which, while it would eventually enable them to secure good laws for themselves, at the same time could alone fit them for their enjoyment. His life, not less than his death, was a sacrifice to his zeal for their improvement; for, with taste and habits that tended to separate him so completely from his subjects, his residence, even as a king, in Scotland, must have been felt by him as far more truly exile, than even his previous imprisonment. Yet we have no reason to think that, although his days were spent first in durance abroad, and then in worse than durance at home, he ever indulged in any weak or undutiful murmuring at his fate. On the contrary, we gather, from all that is related of him, that, during the short period of his life when he was permitted to mix with the world, he showed himself of a cheerful and even joyous spirit, and found the means of making himself happy, even in the midst of the hardest fortune that was dealt out to him. With his intellectual endowments and his love of letters, he had sources of happiness

which few in his station have ever enjoyed, and these were blessings, which the vicissitudes of outward fortune had but little power to affect.

We might add several names to the list of learned kings. HENRY I., in the early part of the twelfth century, obtained the surname of *Beauclerc*, or the Learned, from his proficiency in the literature of the times. During the sixteenth century, classical and theological erudition was so much in fashion, that persons of the very highest rank, and of both sexes, very generally received what is called a learned education. It is related of the emperor Charles V., that having been, upon one occasion, addressed by an ambassador in a Latin oration, he was so much affected, at finding himself unable perfectly to follow the speaker, that he publicly reproached himself for his inattention, when a boy, to the instructions of his tutor,* who, he remarked, had often warned him, that a day would come, when he would regret his negligence. So universally, in those days, was this sort of learning expected in crowned heads. Accordingly we find almost all English sovereigns, of that age, proficients in the ancient languages, and adepts in polemical divinity. Henry VIII. disputed, through the press, with Luther, in Latin. His son, Edward VI., had he lived, would probably have given proofs of still greater accomplishments in the same department of scholarship. One of his tutors was Sir John Cheke, of whom Milton speaks, in a wellknown sonnet, as having taught "Cambridge, and King Edward, Greek;" and it is a curious illustration of the times, that this learned individual was soon after selected to fill the office of Secretary of State. Queen ELIZABETH, we need hardly remark, is famous as a learned princess. She, also, like her royal predecessor, King Alfred, completed an English translation of Boethius's 'Consolations of Philosophy;'—a work which, in addition to having been thus rendered into the vernacular tongue by two of the greatest of English monarchs, had the honor of receiving the same service from Chaucer, the father of

* The same who afterwards became Pope, under the title of Adrian VI.—See vol. i. p. 204.

English poetry.* Elizabeth's successor, JAMES, had more learning than good sense, and was a pedant, rather than a scholar; but, with less learning, he certainly would not have been a wiser king. He is the instance, however, that has perhaps contributed, more than any other, to confirm the common prejudice, that a taste for letters is, after all, no very desirable quality in the possessor of a throne. If it be meant, that literary kings have generally been bad kings, the notion is certainly not borne out by the facts of history. It may be asserted, with much greater truth, that, in all of those, who, notwithstanding their scholarship, have shown themselves unworthy of their high station, that scholarship has yet been a redeeming quality, both in itself, and in its effects. If, again, all that is meant, be only that learning has some tendency to become pedantic on a throne, this may be admitted; for it is a natural consequence of the possession being so unusual: but even this result, where it has happened, has, in by far the majority of cases, formed but a very trifling drawback upon the good with which it was connected. James certainly has not gained much credit to his name by his authorship; though it deserves to be remarked, that it is posterity that has been least indulgent to his pretensions. In his own day, his learning procured him great admiration, not only from the mere courtly flatterers of the time, but from many of its most distinguished scholars; for evidence of which, we need go no further than to the dedication of their work addressed to him by the authors of our admirable translation of the Bible, and still commonly printed at its head. The character of the man, however, the species and quality of the learning which he had acquired, and above all the spirit of the age, had more share in making James the pedant that he was, than any disadvantage under which his station placed him.

Another name, which is sometimes quoted as that of

* The original copy of Queen Elizabeth's translation of Boethius, partly in her majesty's handwriting, and partly in that of her secretary, was discovered, not many years since, in the State Paper Office.

a king to whom learning was a misfortune, rather than a blessing, is that of the celebrated ALPHONSO X., king of Castile and Leon, commonly called the *Wise*. This prince, who lived in the thirteenth century, was certainly unlucky in his schemes of political ambition; and the vain attempt he made to obtain possession of the imperial crown, involved him in a series of calamities, and eventually led to his dethronement. But it does not appear that his literary and scientific acquirements, so extraordinary for his age, had any thing to do in occasioning the errors to which he owed his ruin, or that, with less learning, he would have been either more prudent, or more fortunate. As it was, Alphonso, notwithstanding the troubles in which his reign was passed, conferred such services, both upon his own country and upon the world at large, as few royal names have to boast of. Spain owes to him, not only her earliest national history and translation of the Scriptures, but the restoration of her principal university, the introduction of the vernacular tongue in public proceedings and documents, and the promulgation of an admirable code of laws; and science is indebted to this monarch for the celebrated astronomical tables known by his name, the earliest which were compiled subsequently to those given in the Almagest of Ptolemy, who flourished in the second century. According to some accounts, Alphonso spent the large sum of 400,000 crowns on the preparation of these tables, in which he was assisted by others of the most learned astronomers of the time. They went through several editions, even after the invention of printing, and continued, indeed, to be generally used by astronomers, till the commencement of the sixteenth century.

CHAPTER II.

Peter the Great, (Czar of Russia.) NOTE.

BUT the pursuit of knowledge is not necessarily confined to the study of books; and, therefore, although we pass over many other names that might be here introduced, we must not omit that of a sovereign, who distinguished himself by his ardor in this pursuit, in a variety of ways, and was, in all respects, one of the most extraordinary men that ever lived,—the Czar PETER I., of Russia. Peter was born in 1672, and at ten years of age, found himself in nominal possession of the throne; although, for some time, all the actual power of the state remained in the hands of his sister, the princess Sophia, who was about five years older than himself. But his boyhood was scarcely expired, when he gave proof of the energy of his character by ridding himself of this domination; and in 1689, the princess was already removed from the government, and immured in a monastery. From this moment, the young czar, now absolute in reality, as well as in name, directed his whole efforts to the most extraordinary enterprise in which a sovereign ever engaged; being nothing less than to change entirely the most settled habits and prejudices of his subjects, and not so much to reform them, as to transform them, almost by main force, from barbarians into a civilized people. For the Russians at this time, (not more than a century and a half ago,) were, in truth, little better than a nation of savages. Nay, Peter, himself, was born and reared a savage; and to his last days, the passions and propensities of his original condition remained strong in his nature. It speaks the more for his wonderful genius, that, throughout his whole history, he forces us to feel that we are reading the adventures of the chief of a barbarous country, struggling to civilize himself as well as his people.

And, undoubtedly, we do not follow his progress with the less interest, on that account. Nothing, in fact, in his proceedings or his character so much engages our curiosity, as to watch the astonishment with which his own ignorance was struck, on the first view of those arts of civilized life, which he was so anxious to introduce among his less ambitious, but hardly more ignorant, subjects. It is exactly the case of a strong-minded and enterprising leader of some tribe of wild Americans or South Sea islanders, setting out to see, with his own eyes, the wonders of those distant lands, of which his white visiters have told him, and, after all, viewing the scenes, which civilization presents to him, with an intoxication of surprise, which shows how imperfectly even his excited fancy had anticipated their actual nature. But, however he was at first struck with what he beheld, Peter did not continue long lost in mere amazement. The story which is told, of the occasion which awakened him to the ambition of creating a Russian navy, is very illustrative of his character. While looking about, one day, among some old stores and other neglected effects, he chanced to cast his eye upon the hulk of a small English sloop, with its sailing tackle, lying among the rest of the lumber, and fast going to decay. This vessel had been imported, many years before, by his father, Alexis Michelovitch, also a prince of distinguished talents, and who had nourished many schemes for the regeneration of his country; but it had long been forgotten, by every body, as well as the object which it was designed to promote. No sooner, however, was it observed by Peter, than it fixed his attention; he made inquiries of some of the foreigners by whom he was surrounded, as to the use of the mast and sails, even the general purposes of which he did not know; and the explanations which he received, made him look on the old hulk with new interest. It immediately became, in his imagination, the germ of a magnificent national marine; and he could take no rest till he had made arrangements for having it repaired and set afloat. With some difficulty, the Dutch pilot was found out, whom Alexis had procured, at the same time with

the sloop, to teach his subjects the method of managing it; the man, like the vessel, of which he was to have the charge, had long been forgotten by all the world. Once more, however, brought out of his obscurity, he soon refitted the sloop; and the Czar was gratified, beyond measure, by at length beholding it, with its mast replaced, and its sails in order, moving on its proper element. Delighted, as he was, he went himself on board, and was not long, before he became a sufficiently expert seaman, to take the place of his Dutch pilot. For several years after this, his chief attention was given to maritime affairs; although his first ships were all of foreign construction, and it was a considerable time before any issued from his own docks. From so small a beginning as has been described, Russia has since become one of the greatest naval powers in the world.*

But the most extraordinary of the plans which Peter adopted, in order to obtain an acquaintance with the arts of civilized life, was that, which he put in execution in 1697, when he set out, in the suite of his own ambassador, to visit the other countries of Europe. On this occasion, passing through Prussia, he directed his course to Holland, and at last arrived in the city of Amsterdam. His embassy was here received, by the government of

* The most detailed account we have met with, of the story told in the text, is one preserved among the MSS. of Sir Hans Sloane, in the British Museum, (No. 3, 168.) It appears to have been written shortly after the death of Peter the Great, and by a person who was either a native of Russia, or had resided in that country. According to this authority, the incident took place in the flax-yard at Ishmaeloff, an old seat of the royal family, near Moscow. The writer gives us also an account of a great naval show, at which he was himself present, in honor of this celebrated vessel, which took place, by the emperor's command, at St. Petersburg, on the 12th of August, 1723. On this occasion, the sloop, or ship's boat, as it is here called, having been repaired and beautified, was received by about 200 yachts, and, having advanced to the harbor, attended by that numerous convoy, was then saluted by a general volley from the twenty-two men-of-war, which might be considered as forming its progeny. The emperor, of course, was present, and the day was altogether one of the greatest festivals that had been known in Petersburg. "A few days after," it is added, "the boat was brought to Petersburg, and laid up in the castle, where she is to be taken the greatest care of."

the United Provinces, with all manner of honor and distinction; but he himself refused to be recognised in any other character than as a private individual. The first days of his visit were spent in perambulating the different streets of the city, the various wonders of which were probably never viewed by any eye with more astonishment and gratification than they excited in this illustrious stranger. The whole scene was nearly as new to him, and as much beyond any thing by which he had ever before been surrounded, as if he had come from another world. The different arts and trades which he saw exercised, and the productions of which met him, wherever he turned, in such surprising profusion, were all attentively examined. But what especially attracted his attention, was, the great East India dock-yard in the village of Saardam, (situated a few miles from Amsterdam,) which was then the principal establishment of this description in Holland. Here, he actually took the singular resolution of entering himself as a working carpenter; and, accordingly, giving in to the superintendent the simple name of *Peter Michaelof*,* he took his place among the other workmen, and became, in all respects, one of them, even wearing the same dress, eating the same sort of food, and inhabiting equally humble lodgings. The hut in which he lived, is still shown at Saardam. When he first made his appearance in the dock-yard, nobody knew who he was, and he of course attracted no notice: but, even after his true quality was discovered, he would suffer none of the observances usual to persons of his rank to be paid to him, repelling every attempt of the kind, with evident displeasure. And in this way of life, he passed several months; during which time, he bore a considerable part in the

* That is, Peter the grandson of Michael, according to the manner of forming the surname in Russia among the lower orders. His majesty's proper designation was Peter Alexovitch, or the son of Alexis. *Of*, or *ow*, as it is pronounced, and often written, seems to be the same with the Celtic *O*, still used as a prefix to proper names in Ireland, and the Scottish *oe* or *oy*, which generally signifies a grandchild, but, in some districts, a nephew, having been applied originally, in all probability, to any near descendant, direct or collateral. *Vitch*, again, is the Norman, or old French, *Fitz*, now *Fils*, a son.

building of a vessel, which, when completed, was named the *St. Peter*, and was purchased by the royal person, whose hands had thus helped to put its timbers together. While thus employed, however, the Czar did not neglect his duties and appropriate occupations as a sovereign. After the labors of the day were over, his evenings were generally employed either in writing despatches to the ministers whom he had left in charge of affairs at home; or in holding consultations with his ambassador regarding the negotiation pending with the Dutch government, in which he took the most anxious interest, as having for its object, the procuring of a supply of vessels and seamen from that power, to aid his favorite scheme of forming a navy for Russia. In this application, however, he was unsuccessful.

On leaving Holland, Peter proceeded to England, in a vessel sent to convey him by the government; but on his arrival in London, he insisted upon still being treated only as a private individual. Here he spent his time, at first, as he had done in Holland, examining the many interesting objects that every where met his view. Among other places, he went to see the Tower, where he was much delighted with the Armory, and the coining of money in the Mint. He was taken also to see the two houses of Parliament, when sitting; and he appeared twice or thrice at the play, but did not seem to have much relish for that species of amusement. He was very fond, however, of visiting the churches; and was so anxious to learn the mode of worship observed by the different denominations of dissenters, that he attended several of their chapels. On one occasion he was present at a Quaker's meeting. He paid one visit to Oxford, to see the University; and another to Portsmouth, where he was greatly entertained by a mock seafight that was exhibited to him. On this occasion, he declared that he considered an English admiral a happier man than a Czar of Muscovy.* He also applied himself, with zeal and diligence, to learn whatever he deemed useful, without regarding the humble nature of any of the handicrafts, in which he wished to become a

* Mottley's Life of Peter the Great.

proficient. With these views, he did not scruple to work, as a common laborer, in papermills, sawmills, ropeyards, and other establishments of a similar kind. Voltaire mentions, (*Histoire de Russie*, i. 159,) that he studied, with particular attention, the art of watchmaking. His first residence was a house appointed for his reception, by government, below York-buildings, in the neighborhood of Westminster-bridge; but he found this both a very noisy place of abode, and not conveniently situated for the object, on account of which principally he had visited England,—his improvement in the art of ship-building. After a short time, therefore, he removed to Deptford; and there he spent several months in the dock-yard, employing himself in the same manner as he had done in that of Saardam. He was so much pleased, it is said, with the superior method of working, which he found pursued in Deptford, that he used to declare he never should have known his trade, had he not gone to England. While at Deptford, he lodged in the house of the celebrated John Evelyn, author of the 'Sylva,' which stood on the site now occupied by the Workhouse of the parish of St. Nicholas. We find the circumstance noticed in Evelyn's Diary, under the date of 30th January, 1698: "The Czar of Muscovy being come to England, and having a mind to see the building of ships, hired my house at Say's court, and made it his court and palace, new furnished for him by the king." He remained here, it appears, till the 21st of April. Some notion of his manner of living, may be obtained from a letter, written during this time, to Evelyn, by his servant: "There is a house full of people, and right nasty. The Czar lies next your library, and dines in the parlor next your study. He dines at ten o'clock and six at night, is very seldom at home the whole day, very often in the king's yard or by water, dressed in several dresses. The king is expected there this day, the best parlor is pretty clean for him to be entertained in. The king pays for all he has."*

While the dock-yard, however, was the place in which the Czar spent the greater part of the day, he employed

* Bray's Memoirs of Evelyn, ii. 60

many of his leisure hours in taking lessons in mathematics, navigation, and even anatomy, which he had begun to study while in Holland, under the instruction of the eminent professor, Frederick Ruysch, whose museum he afterwards purchased, for the sum of thirty thousand florins. Peter, indeed, neglected no opportunity, during his travels, of forming the acquaintance of distinguished individuals; and both in Holland and England, many of the ablest men of the time were introduced to him, some of whom he persuaded to accompany him home to Russia. He also expended considerable sums in purchasing such curious productions of art, as he conceived might best excite the emulation of his subjects.

Among other persons who were made known to him when in England was Bishop Burnet, who does not seem, however, to have comprehended the character of the extraordinary man with whom he was on this occasion brought into contact. In the History of his own Times, he tells us the impression the Czar made upon him. "He wants not capacity," says he, "and has a larger measure of knowledge, than might be expected from his education, which was very indifferent;" but immediately after, he adds, that he "seems designed, by Nature, rather to be a ship-carpenter, than a great prince." He did not, at that time, appear to the bishop to be capable of conducting so great a design as the attack upon the Turkish empire, which he was understood to be meditating; although it is acknowledged, that he afterwards displayed a greater genius for warlike operations than the writer then imagined him to possess. Bishop Burnet had a good deal of conversation with him upon religious matters, and remarks, that "he was desirous to understand our doctrine, but he did not seem disposed to mend matters in Muscovy." He allows, however, that he was "resolved to encourage learning, and to polish his people by sending some of them to travel in other countries, and to draw strangers to come and live among them." The learned prelate concludes his account, by the following curious reflection: "After I had seen him often, and had conversed much with him, I could not but adore the

depth of the providence of God, that had raised up such a furious man to so absolute an authority over so great a part of the world."

We cannot here enter into any detail of the various reforms in the customs of his people, which this extraordinary man proceeded to introduce, on his return to his own dominions, with the view of assimilating them more to those which he had found prevailing in the other countries of Europe. Suffice it to say, that, by a series of the most energetic and frequently violent measures, he succeeded in effecting a complete change in some of the oldest institutions of his empire, and even commenced a revolution in the habits and manners of general society, which, from that beginning, has since gone on till it has established, in what was, before, almost a barbarous country, all the benefits of a flourishing civilization. Peter may be said, indeed, to have given to his subjects, nearly every art of civilized life, of which they were some time afterwards found in possession. He taught them navigation, commerce, and even agriculture and the management of flocks, having imported from Saxony and Silesia both herds of sheep and shepherds to take care of them. He called to him artists of all descriptions from other countries, and employed them in contriving, each in his appropriate department, how best to bring into developement the natural resources of the country. He built a new capital, the first truly European city that had been seen in Russia, on a site which did not form part of the empire at his accession. Finally, he founded schools, academies, colleges, libraries, and museums, and thus laid the surest of all foundations for the permanent and progressive improvement of his people.

A college of physicians, a dispensary, an observatory, and a botanical garden, were among the establishments, with which he adorned his two capitals. The art of printing had been introduced into Russia, about the middle of the sixteenth century; but this early press seems to have hardly left any trace of its operations, and Peter, at his accession, found his country without books. To supply this deficiency, he had some scientific works trans-

lated into Russian; and, when he was in Amsterdam, he employed a printer of that city to print them, giving him a monopoly for the sale of them in Russia. His majesty, himself, some time after this, remodelled the alphabet of his native language, considerably simplifying the forms of the characters, and established several printing-houses in Petersburg, at which various elementary works were thrown off, mostly translated from foreign tongues. From this beginning, the literature of Russia has so much increased, that in M. Sopikof's *Essai de Bibliographie Russe*, no fewer than thirteen thousand two hundred and forty-nine works are enumerated, as having appeared in the native language up to the year 1813. In the three years from 1822 to 1824, inclusive, there appeared two hundred and seventy-five translations from French, German, English, Greek, Latin, Italian, Sclavonic, Dutch, Danish, and Armenian, and five hundred and fifty-eight original works; in all eight hundred and thirty-three publications, besides works in foreign languages.

In 1717, the Czar set out on a second foreign tour, attended on this occasion as became his rank. In the course of his progress, he visited successively, Hamburgh, Berlin, Amsterdam, and Paris; in the last of which cities, especially, he found all that the arts had yet contrived for the use and enjoyment of man, in the highest state of advancement. He no longer now applied his hand to the practice of the different crafts which he inspected: his days of apprenticeship were over; but he was not on that account less diligent in visiting every workshop and manufactory in which any thing novel or curious was to be seen. He went also to see the observatory, the libraries, and the different learned institutions; and was present at a sitting of the Academy of Sciences, which admitted him one of its members.

This great man's education, in his youth, had been worse than neglected. His sister and her counsellors had even surrounded him with every seduction most calculated to deprave both his moral and intellectual nature, and to stifle in him the desire of knowledge. The bad parts of his character were, undoubtedly, in a great measure,

the result of the manner in which he was treated at this time of his life. Yet, violent and ungovernable as his passions continued to be, in some respects, to the last, making him act often with a ferocity unsurpassed by any thing that is told of the excesses of infuriated savages, he succeeded in completely overcoming that one of his evil habits which he found would have interfered most with the conduct of his great schemes. In his youth, he was a slave to the love of ardent spirits, but he had weaned himself entirely, in his maturer days, from that destructive vice; nor was he insensible to the other defects of his original character which he had failed to correct. "Alas!" he would sometimes exclaim, on recovering from one of those paroxysms of rage, by which he was liable to be carried away, "I have reformed my people, but have not been able to reform myself." Perhaps, however, no man, in any station, ever did more than this illustrious monarch, to repair the mischievous consequences of a neglected youth, as far as intellectual acquirements are concerned. In addition to a competent knowledge of mathematics, mechanics, navigation, medicine, and anatomy, he appears to have made himself master of more than one of the modern languages of Europe. He translated several works from the French, the manuscripts of which are still preserved at Petersburg. He had even made himself familiar with the Latin tongue, if we are to believe an anecdote, told by M. Stählin,* of his detection, upon one occasion, of the inaccuracies of a monk, whom he had employed to translate a work, written in that language, into Russian. But as the original of the work in question, (Puffendorff's Introduction to the History of Europe,) is in fact not in Latin, but in German, it is probable that it was by his acquaintance with the latter tongue, or with the French, into which the book had also been translated, that Peter was enabled to discover the defects of the Russian version. M. Stählin tells us another anecdote, which shows how fully his majesty understood the value of that early instruction which he had not himself enjoyed. Finding

* Original Anecdotes of Peter the Great; London, 1788.

two of his daughters one day reading a French author, he desired one of them to translate the passage before her into Russian; when, struck with the facility with which the task was performed, he exclaimed, "Ah! my children, how happy are you, who are thus taught to read in your youth, and enjoy all the advantages of an education, which I totally wanted." He used often to say, that he would willingly have lost one of his fingers to have had a good education in his youth.

When he began, at last, to educate himself, he did not neglect even the more elegant and ornamental acquirements. During his first visit to Holland, he had an opportunity of seeing many good pictures; and this gave him a taste for painting, to which he was ever afterwards much devoted. Even while at Amsterdam, many of his hours were spent in the working-rooms of the eminent artists who then resided in that city, some of whom he engaged to accompany him to Russia. He afterwards expended very considerable sums in the purchase both of pictures and sculptures; and commenced the formation of a gallery of these works of art at Petersburg. He also formed a valuable collection of medals. Every department of liberal knowledge, indeed, found in Peter a munificent patron, and, so far as his leisure and opportunities permitted, even an ardent cultivator. When passing through any country interesting from its historical recollections, were he conducting his army on a warlike expedition, he would go many miles out of his way, to examine a celebrated ruin, or to tread a spot that fame had consecrated. In the same spirit, he was especially solicitous for the preservation of the old historic memorials of his own country. While travelling, his constant habit was to obtain as much information as he could beforehand, with regard to every place he was about to visit; and even when he approached the smallest village, he would inquire if it contained any thing remarkable. If those about him told him it did not, he would reply, "Who knows? if it be not so to you, perhaps it is to me; let me see all." When setting out on his investigations, on such occasions, he carried his tablets in his

hand; and whatever he deemed worthy of remembrance, was carefully noted down. He would often even leave his carriage, if he saw the country people at work, by the way side, as he passed along, and not only enter into conversation with them, on agricultural affairs, but accompany them to their houses, examine their furniture, and take drawings of their implements of husbandry.* He obtained, in this manner, much minute and correct knowledge, which he could scarcely have acquired by other means, and which he afterwards turned to admirable profit, in the improvement of his own country.

M. Stählin, whose notices are in general well authenticated, and may be depended on, except where it is likely that his authority was deceived, relates some curious anecdotes, in illustration of the Czar's predilection for operations in surgery, which show, at least, that he had made no inconsiderable proficiency in the art. He was rarely absent, when a dissection took place in Petersburg; and occasionally he assisted as one of the operators. He let blood and extracted teeth, with great expertness; and he is recorded to have once tapped a patient for dropsy. These may not seem the most appropriate accomplishments for a king; but we must remember the peculiar circumstances of Russia, during the reign of this great author of her civilization. On the one hand, the simplicity of the national manners was such, that it was not held at all indecorous for the emperor to mix in the domestic circles of his subjects, almost as one of themselves; and, on the other, the prejudices of the people were so strong, and their aversion to innovation so bigoted, that probably nothing less than the actual example of their sovereign, would have roused them to take any interest in the new arts he wished to introduce among them. Peter, therefore, rightly felt, that the consideration of the undignified nature of some of the occupations in which he engaged, was far more than overbalanced by the advantages that his personal exertions gave him, in overcoming the inertness and positive opposition on the part of his countrymen, which his reforms had to encounter.

* Stählin's Anecdotes.

This must be his apology, also, (if the case shall be thought to require any,) for certain other labors to which he was sometimes wont to apply his hand. He once passed a month, M. Stählin tells us, at Müller's iron-works, at Istia, about seventy miles from Moscow, during which time he employed himself in learning the business of a blacksmith; and so much progress did he make, that, on one of the last days of his stay, he forged, with his own hand, seven hundred and twenty pounds of iron, making his mark on each bar. On his return to Moscow, he proceeded to Müller's house, and, having received from that gentleman the same pay for his labor which would have been allowed to any other workman, about two shillings, English money, he immediately went and purchased a pair of shoes with it, which he ever afterwards took great pleasure in showing. One of the bars he forged on this occasion, is still to be seen at Istia. He was also accustomed, according to Voltaire,* to take his place sometimes among the men employed in cutting canals, a species of public labor on which he expended large sums, in order to encourage and animate them, in the more difficult parts of their work. But his favorite art was that of ship-building, his lessons in which, learned in Holland and England, he took care not to forget, on his return home. The writer of the manuscript narrative in the British Museum, to which we have referred, in a note on a former page, gives us some curious information in relation to this matter.

The Czar, he tells us, as soon as he got back from England, went down to Veronez, whither he carried two English builders, named Dean and Noy, whom he had brought out with him. Of these, however, "the first," the narrative continues, "soon after desired a discharge, which was granted, without giving any proof of his art. The Czar, himself, and Joseph Noy, received orders from the Lord High Admiral, Theodore Alexowitz Golovin, to build, each of them, a man-of-war. The Czar, having taken upon himself the title of a master ship-build-

* Histoire de Russie, ii. 186.

er, was pleased to subject himself to the condition of that character; and, in compliance with that order, gave the first proof of his skill in the art which he had learned abroad; and continued afterwards to bear that title, and had, at all times, notwithstanding his great engagements in many other affairs, one ship upon the stocks; and at his death left one ship half built, one of the largest in Europe, one hundred and eighty feet long upon the deck, fifty-one broad, and twenty-one deep, and mounts one hundred and ten guns, and is by relation one of the finest bodies that has ever been seen; as were, indeed, all the rest he built. He himself drew the draught of this great ship, at Riga, where was no master ship-builder but himself; and when he returned to Petersburg, he gave the surveyor an account, that he had drawn his draught of the great ship, which he had orders to build from the surveyor's office, and, according to the regulations of the navy, presented his draught to be examined."

The emperor, this writer adds, collected the results of his experience and reading upon the subject of ship-building, and formed them into a regular treatise on his art. This work, however, has not been published, although it is probably preserved, with the other literary productions of the writer, in the Imperial Library at Petersburg. The only work, from the hand of Peter the Great, which has been printed, is his Journal, from 1698 to the peace of Neustadt, in 1721. Of this document, which is almost entirely occupied with military transactions, a French translation, by M. Formey, was published at Berlin, in 1773, in one volume, quarto.

Peter died in 1725, in the fifty-third year of his age. His history presents us with, perhaps, as remarkable a case of the conquest of difficulties, in the pursuit of knowledge, as it would be possible to quote. In his noble resolution to educate not only himself but his country, he had to contend with obstacles, at every step, which nothing could have overcome, but that determination to succeed which overcomes all things. Few monarchs have better deserved the epithet of Great, if he is to be appreciated either by the great powers of mind he displayed,

or the great effects he accomplished. And of these last, it is to be remarked that none have passed away; all have been permanent and productive. Compare Peter the Great, in this respect, with many other characters, who, during their time, have filled the earth with the noise of their exploits; and how high must he be placed above them! Alexander's mighty empire fell to pieces, as soon as his own hand had resigned its sceptre; so did that of Charlemagne; so did that of Bonaparte. These, all, after moving every thing, established almost nothing.* But whatever the Russian planted, still grows and flourishes, and bears fruit, more plentifully, every year. The reason is, that, while other builders-up of empires have trusted, for the support of their institutions, alone or chiefly to the sword, he based his on the moral strength of knowledge and civilization.

NOTE.

[The career of Peter the Great presents an illustrious instance of what may be the results of the labors of a single lifetime, when they are put forth in *a proper direction*. The men who have been gifted with the greatest talents, or the richest opportunities, or who have performed the most brilliant achievements, as they are commonly estimated, are not those whose lives have produced the greatest effects. It is the effort to *do good*, to make men *happier*, or *wiser*, or *better*, that produces the most durable result. This is as true of private persons as of kings and emperors. Robert Raikes will be remembered, as the founder of the first Sunday School, as long as a child receives the benefit of his benevolent example. John Howard will be called to mind, as the author of a new era in philanthropy, as long as a poor prisoner is relieved from suffering, or a vicious criminal reclaimed from his wickedness. No one of his scientific achieve-

* The Code of Laws, called after his name, is the only permanent monument of his power which Napoleon has left in France. Where he applied his ability to the real advancement of civilization, the traces of his career were not to be effaced by changes of rulers or of opinions

ments gave to Sir H. Davy so much pleasure, as the invention of the safety-lamp. If we desire to immortalize ourselves, let us then attempt to confer some benefit on our fellow-men. AM. ED.]

CHAPTER III.

Advantages of Wealth in the Pursuit of Knowledge :— Napier.

NOTWITHSTANDING the honorable reputation which the princes we have named, and others whom we have not room to notice, have acquired by their devotion to intellectual pursuits, it is to be observed, that science and literature have been much more indebted to the example and patronage, than to the actual performances, of the royal personages who are to be counted among their friends. No great discovery or immortal composition claims a king as its author. When the genius that might have accomplished such, has been found on a throne, it has been otherwise occupied, than with the quiet, but ennobling pleasures of learning and philosophy. And doubtless this is only as it should be. Men have not crowns put upon their heads; that they may write books, or spend their lives in constructing philosophical theories. Every station has its peculiar duties, which must first be attended to, even before the pursuit of knowledge ; and those of sovereigns are sufficiently arduous, to make it impossible, when they are fully performed, that this pursuit can be any thing more than the avocation of their leisure. To this extent, only, therefore, it is desirable that they should devote themselves to it. But if so, it cannot be expected that this class of persons should contribute many, or even any, names of first-rate distinction to the history of literature or science. It were not fitting, indeed, that the same individual should have supremacy,

at once, in two worlds, so entirely different and unconnected, as that of political dignity and that of genius. All, therefore, we repeat, which philosophy and the arts usually have to ask of kings, is, their protection and countenance, and an example, which may at least evidence an attachment to intellectual pursuits, even while duties of another sort demand the chief attention. Whether letters, generally speaking, flourish best, with, or without, the patronage of courts, we do not here stop to inquire. It is, at all events, certain, that in some cases the literary progress of a country has been greatly indebted to a love of literature in its sovereign. Thus it was, that Alfred imported civilization into England, James I. into Scotland, and Peter the Great, into Russia.

But other individuals, in possession of wealth or rank, are differently situated from kings. They have often no public duties to perform, or none from which they may not disengage themselves, in so far, at least, as they would interfere with the closest application to intellectual pursuits. In most countries, indeed, they are not called upon to take a part in the management of affairs in ordinary circumstances, by any need that the state has of their services, so much as by their own ambition for political distinction; and so numerous are almost always the competitors, here, that an individual who chooses to withdraw from the throng, will rarely have cause to reproach himself with having deserted a post which there are not a hundred others, ready, and as well qualified, to occupy. However, we would neither condemn nor depreciate any path of honorable enterprise; doubtless it is the duty of every man, who believes that he can most benefit his country by his political services, to endeavor to do so. But this is, at least, an ambition by which many are apt to be seduced, who look rather to its glittering prizes, than to their own qualifications; and it is also undeniably one, in which something else than merit often contributes to success. There can be no danger, therefore, of too many persons deserting politics for philosophy. There will always be a sufficient number of our men of wealth and rank to serve the state, and

contend for her honors and her offices, although as many leave the crowd, as the love of study and speculation can possibly withdraw.

But political ambition, in truth, is not that seduction, by which persons of this description are most apt to be enthralled. The besetting temptations attendant upon the possession of wealth and leisure, (which, rightly employed, constitute such inestimable advantages,) are the facilities which they afford to the indulgence of mere indolence and love of pleasure. A rich man, who can live without exertion of any kind, is apt to lose the power even of that degree of exertion which is necessary for the acquisition of knowledge. Besides, his money provides him with other enjoyments ; and he often never even acquires a taste for those of an intellectual kind. A defective or misdirected education, too frequently, only prepares him the better for yielding to the unfortunate influences of his condition ; and the habits and prejudices of society come also to assist their force and confirm their dominion. When an individual, thus circumstanced, therefore, betakes himself, in good earnest, to the pursuit of knowledge, he, also, is entitled to be regarded as one who has exhibited much energy of character, and conquered many difficulties, as well as he, who has had to struggle with poverty, or an uncongenial occupation, in his attempts to obtain an acquaintance with books. The impediments which have lain in the way of the former, are different from those that have beset the path of the latter ; but they may not have been less difficult to overcome. The fact, at all events, is, that the temptations of wealth have often exerted as fatal an effect in repressing all ardor for intellectual pursuits, as ever did the obstructions of indigence.

Yet, where the love of knowledge has taken full possession of the heart, the rich man is in a much more favorable situation than the poor man, for the prosecution of great enterprises in science or literature. Those demand both leisure and ease of mind—two good things, of the first of which, generally but little, and of the second, often not much, are his who has to provide for his daily

bread by his daily labor. Hence, some of the greatest names, in all departments of philosophy and learning, are those of persons, who, unembarrassed by the toils and cares of obtaining a subsistence, have been free to lead a life of contemplation, having purchased to themselves that inestimable privilege by a relinquishment of the other pleasures or objects of ambition, ordinarily followed by those in their situation, and seeking no other advantage from their riches, or their competence, than that of being at liberty to devote their time, and their powers of mind, to labors of their own choosing. From the list of the illustrious of ancient times, we need mention no others, and we can mention no greater, than Plato and Archimedes; both of whom were of distinguished birth, (the former being a descendant of the family of Solon, the other a near relation of king Hiero,) and, there is every reason to suppose, opulent. But we pass from times so remote, that, even when the circumstances of the case are well ascertained, the changes that have taken place in every thing detract from the value of an example or illustration, in order to notice two or three of the more remarkable instances which belong to a state of society more nearly resembling our own.

The first name we shall mention is that of JOHN NAPIER,—often, but erroneously, called Lord Napier. He was not a nobleman, but only what would in England be called a lord of a manor. Such persons, in Scotland, were formerly designated *barones minores*, or *lesser barons*; and to this class the baron of Bradwardine belonged, as well as Napier, who in like manner was baron, or, as he himself expresses it, 'Peer of Marchistown,'*—an old seat of the family in the neighborhood of Edinburgh. Here, or, according to other authorities, at Gartness, in

* In his dedication of 'A Plaine Discovery of the whole Revelation of St. John.' So, on the title-page of his 'Mirifici Logarithmorum Canonis Descriptio,' (Edin. 1614,) he calls himself, 'Baro Merchistonii.' He was not, on this account, however, either the 'Lord Marchiston,' as he is described by Lilly the astrologer, or 'the Lord Napier,' as he has been called by others. He was merely *laird* of Merchiston; a title which, although of course etymologically identical with the English *lord*, is applied in Scotland to any landed proprietor.

Stirlingshire, (an estate which also belonged to the family,) Napier was born, in the year 1550, at which time his father, who lived for fifty-eight years after this, could not have been older than sixteen. In 1562, he entered St. Salvator's college, St. Andrew's, as appears by the books of the university.* At this time, of course, he was only twelve years old; but this was not an unusually early age, in those times, for going to the university in Scotland. Many entered even younger; and in the university of Glasgow, it was found necessary to make a law that no student should be admitted to the degree of bachelor of arts before the age of fifteen, unless upon good reason appearing to dispense with a year in any particular case. Napier's own language, therefore, is not inappropriate, when, in his treatise on the Apocalypse, published in 1593, he tells us that it is "no few years" since he began to "precogitate the same," being then, as he adds, in his "tender years and barneage (childhood) at St. Androes, at the schools."

On leaving college, Napier is understood to have set out on his travels, in the course of which he visited France, Italy, and Germany. It is not known when he returned home; but he was probably a considerable time abroad, since we hear nothing further of him till he was above forty years of age. On arriving again in his own country, although he had already acquired considerable reputation for abilities and learning, and might probably have entered upon a political career with many advantages, he declined interfering in public affairs, and retired to Merchiston, with the intention of devoting himself exclusively to study. A room, in which he used to seclude himself, for this purpose, at the top of the old tower of Merchiston, is still shown. He also resided, occasionally, at Gartness, where he was looked upon by the common people, we are told, as a wizard—a common fate of learned and studious

* Lord Buchan, in his life of Napier, (Edinb. 1788,) conjectures that he did not go to college till 1566; and observes, that the records of the university do not ascend higher than the beginning of the seventeenth century. The fact is, that they reach to the year 1413, when the university was opened.

men, down even to an age so recent as this, although Napier's is probably one of the latest names that acquired this species of celebrity. As an evidence that his renown for more than mortal knowledge was not confined to the simple peasantry of Stirlingshire, we may mention, that there is preserved in the British Museum, a small tract, printed in London, of which the following is the title: 'A Bloody Almanack, foretelling many certaine predictions which shall come to pass this present yeare, 1647; with a calculation concerning the time of the day of judgement, drawne out and published by that famous astrologer, the Lord Napier, of Merchiston.'

But, the fact is, that, although Napier did not himself profess to be either necromancer or astrologer, he cannot be altogether acquitted of pretending to this very insight into futurity which is here attributed to him. The first publication, which he gave to the world, was an exposition of the Revelations, which appeared at Edinburgh, in 1593, prefaced by a dedication to James VI., which is characterized by singular plainness of speech. "Verily and in truth," says the writer, "such is the injury of this our present time, against both the church of God and your majesty's true lieges, that religion is despised and justice utterly neglected; for what, by atheists, papists, and cold professors, the religion of God is mocked in all estates; again, for partiality, prolixity, dearth, and deceitfulness of laws, the poor perish, the proud triumph, and justice is no where to be found." He then beseeches his majesty to attend, himself, to these enormities, assuring him, that, if he act justly to his subjects, "God will ministrate justice to him against all his enemies, and contrarily, if otherwise." In redressing the evils denounced, he goes on to exhort him to "begin at his own house, family, and court;" a step, the necessity of which he endeavors to impress upon him at considerable length, and with extraordinary intrepidity. There is not a word of flattery in the whole epistle. As for the work, itself, it is of a similar character to many others, that have been written upon the same mysterious subjects. The most important proposition which it professes to demonstrate,

is, that the end of the world is to take place some time between the years 1688 and 1700. It is a large and elaborate treatise, and is garnished, occasionally, with effusions in rhyme, sometimes original, and sometimes translated. Among other aids, the author presses the famous Sibylline oracles into his service, ornamenting them with a metrical version and a commentary. This work appears to have attracted a great deal of attention, on its first appearance, and to have retained its popularity for a considerable time. It did not, perhaps, cease to be generally remembered, till the termination of the seventeenth century effectually refuted its conclusions. A fifth edition of it, we observe, appeared at Edinburgh, in 1645, which was, perhaps, not the last. It was translated into the French language, and published at Rochelle, in 1602.*

Napier's mathematical studies, after all, however, probably did more to procure for him the reputation of being a magician, than even these theological lucubrations. It was believed, it seems, that he was attended by a familiar spirit, in the shape of a large black dog. A curious anecdote, for the truth of which, undoubted evidence exists, would even lead us to suppose that he was not, himself, averse to being thought in possession of certain powers or arts not shared by ordinary men. A document is still preserved, containing a contract which he entered into, in July, 1594, with a brother baron, Logan of Restalrig, to the effect that, "forasmuch as there were old reports and appearances that a sum of money was hid within Logan's house of Fastcastle, John Napier should do his utmost diligence to search and seek out, and by all craft and ingine to find out the same, and by the grace of God shall either find out the same, or make it sure that

* Napier's book probably occasioned some controversy. There is a MS. in the British Museum, entitled, 'Porta-Lucis, or the way to decypher the name, number, and mark of the Beast, by a method more rational, free, and unstrained, than ever any hitherto; occasioned by the peremptore determination of the Lord Napier, of Merchistoune, upon the name *Λατεινος*.' The only part of the promised treatise, however, which the MS. contains, is the Preface, in twelve and a half closely written folio pages.

no such thing has been there. For his reward, he was to have the exact third of all that was found, and to be safely guarded by Logan back to Edinburgh, with the same; and in case he should find nothing, after all trial and diligence taken, he refers the satisfaction of his travel and pains to the discretion of Logan."* This, it will be observed, is very cautiously expressed, and so as not distinctly to advance, on Napier's part, any claim to supernatural skill; but a person engaging in such negotiations, could hardly be very much surprised, in that age, if he was held to be acquainted with more of the sciences than he chose to admit. The whole affair places before us a very curious picture of the times.

We do not know, exactly, when it was that Napier deserted theology for mathematics; having in this respect taken just the opposite course to that followed long afterwards by the celebrated Count Swedenborg, who, having been all his previous life a mere man of science, began, when between fifty and sixty years of age, to see visions of the spiritual world, and to converse with angels. But the work upon the Apocalypse was, at any rate, the last of his theological publications. He is understood to have devoted his attention, in subsequent years, chiefly to astronomy, a science, which, recently regenerated by Copernicus and Tycho Brahe, was then every day receiving new illustrations, from the discoveries of Kepler and Galileo. The demonstrations, problems, and calculations of this science, most commonly involve some one or more of the cases of trigonometry, or that branch of the mathematics, which, from certain parts, whether sides or angles, of a triangle, being given, teaches how to find the other which are unknown. On this account, trigonometry, both plane and spherical, engaged much of Napier's thoughts; and he spent a great deal of his time in endeavoring to contrive some methods by which the operations in both might be facilitated. Now these operations, the reader, who may be ignorant of mathematics, will observe, always proceed by geometrical ratios, or proportions. Thus, if certain lines be described in or about a triangle,

* Douglas's Peerage, by Wood, ii. 291.

one of these lines will bear the same geometrical proportion to another, as a certain side of the triangle does to a certain other side. Of the four particulars thus arranged, three must be known, and then the fourth will be found by multiplying together certain two of those known, and dividing the product by the other. This rule is derived from the very nature of geometrical proportion, but it is not necessary that we should stop to demonstrate, here, how it is deduced. It will be perceived, however, that it must give occasion, in solving the problems of trigonometry, to a great deal of multiplying and dividing,—operations which, as every body knows, become very tedious whenever the numbers concerned are large; and they are generally so in astronomical calculations. Hence, such calculations used to exact immense time and labor, and it became most important to discover, if possible, a way of shortening them. Napier, as we have said, applied himself assiduously to this object; and he was, probably, not the only person of that age whose attention it occupied. He was, however, undoubtedly the first who succeeded in it,—which he did, most completely, by the admirable contrivance which we are now about to explain.

When we say that 1 bears a certain proportion, ratio, or relation to 2, we may mean any one of two things; either that 1 is the half of 2, or that it is less than 2 by 1. If the former be what we mean, we may say, that the relation in question is the same as that of 2 to 4, or of 4 to 8; if the latter, we may say that it is the same as that of 2 to 3, or of 3 to 4. Now in the former case we should be exemplifying what is called a *geometrical*, in the latter, what is called an *arithmetical*, proportion; the former, being that which regards the number of times, or parts of times, the one quantity is contained in the other; the latter regarding only the difference between the two quantities. We have already stated, that the property of four quantities, arranged in geometrical proportion, is, that the *product* of the second and third, *divided* by the first, gives the fourth. But when four quantities are in arithmetical proportion, the *sum* of the second and third,

diminished by the *subtraction* of the first, gives the fourth. Thus, in the geometrical proportion, 1 is to 2, as 2 is to 4; if 2 be multiplied by 2, it gives 4, which, divided by 1 still remains 4; while, in the arithmetical proportion, 1 is to 2, as 2 is to 3; if 2 be added to 2 it gives 4, from which, if 1 be subtracted, there remains the fourth term 3. It is plain, therefore, that, especially where large numbers are concerned, operations by arithmetical, must be much more easily performed than operations by geometrical, proportion; for, in the one case you have only to add and subtract, while in the other you have to go through the greatly more laborious processes of multiplication and division.

Now, it occurred to Napier, reflecting upon this important distinction, that a method of abbreviating the calculation of a *geometrical* proportion might, perhaps, be found, by substituting, upon certain fixed principles, for its known terms, others, in *arithmetical* proportion, and then finding, in the quantity which should result from the addition and subtraction of these last, an indication of that which would have resulted from the multiplication and division of the original figures. It had been remarked, before this, by more than one writer,* that if the series of numbers, 1, 2, 4, 8, &c., that proceed in geometrical progression, that is, by a continuation of geometrical ratios, were placed under, or alongside of, the series 0, 1, 2, 3, &c., which are in arithmetical progression, the addition of any two terms of the latter series would give a sum, which would stand opposite to a number, in the former series, indicating the product of the two terms in that series, which corresponded in place to the two in the arithmetical series first taken. Thus, in the two lines,

1,	2,	4,	8,	16,	32,	64,	128,	256,
0,	1,	2,	3,	4,	5,	6,	7,	8,

the first of which, consists of numbers in geometrical, and

* Namely, by H. Grammateus, in his Commercial Arithmetic, published in German, at Vienna, in 1518; and more clearly by M. Stifels, in his *Arithmetica Integra*, printed at Nuremburg, in 1544. See Montucla, *Histoire des Mathematiques*, ii. 19. Even Archimedes was acquainted with these relations.

the second, of numbers in arithmetical, progression, if any two terms, such as 2 and 4, be taken from the latter, their sum 6; in the same line, will stand opposite to 64, in the other, which is the product of 4 multiplied by 16, the two terms of the geometrical series, which stand opposite to the 2 and 4 of the arithmetical. It is also true, and follows directly from this, that if any three terms, as, for instance, 2, 4, 6, be taken in the arithmetical series, the sum of the second and third, diminished by the subtraction of the first, which makes 8, will stand opposite to a number (256) in the geometrical series which is equal to the product of 16 and 64, (the opposites of 4 and 6,) divided by 4, the opposite of 2.

Here, then, is, to a certain extent, exactly such an arrangement, or table, as Napier wanted. Having any geometrical proportion to calculate, the known terms of which were to be found in the first line or its continuation, he could substitute for them at once, by reference to such a table, the terms of an arithmetical proportion, which, wrought in the usual simple manner, would give him a result that would point out or indicate the unknown term of the geometrical proportion. But, unfortunately, there were many numbers which did not occur in the upper line at all, as it here appears. Thus, there were not to be found in it either 3, or 5, or 6, or 7, or 9, or 10, or any other numbers, indeed, except the few that happen to result from the multiplication of any of its terms by 2. Between 128 and 256, for example, there were 127 numbers wanting, and between 256 and the next term, (512,) there would be 255 not to be found.

We cannot here attempt to explain the methods, by which Napier's ingenuity succeeded in filling up these chasms, but must refer the reader, for full information upon this subject, to the professedly scientific works which treat of the history and construction of logarithms.*

* See especially Montucla, *Histoire des Mathematiques*, ii. 16, &c.; Delambre, *Histoire de l'Astronomie Moderne*, i. 491, &c.; and, where the most complete history of logarithms is to be found, the Preface to Hutton's Mathematical Tables, London, 1785; which is reprinted in the first volume of Baron Maseres's *Scriptores Logarithmici*.

Suffice it to say, that he devised a mode, by which he could calculate the proper number to be placed in the table over against any number whatever, whether integral or fractional. The new numerical expressions, thus found, he called *Logarithms*, a term of Greek etymology, which signifies the ratios of numbers. The table, however, which he published, in the first instance, in his *Mirifici Logarithmorum Canonis Descriptio*, which appeared at Edinburgh, in 1614, contained only the logarithms of the sines of angles, for every degree and minute in the quadrant, which shows, that he chiefly contemplated, by his invention, facilitating the calculations of trigonometry. These logarithms differed, also, from those that are now in use, in consequence of Napier having chosen, originally, a different geometrical series from that which has since been adopted. He afterwards fixed upon the progression, 1, 10, 100, 1000, &c., or that which results from continued multiplication by 10, and which is the same according to which the present tables are constructed. This improvement, which possesses many advantages, had suggested itself about the same time to the learned Henry Briggs, then Professor of Geometry in Gresham College,—one of the persons who had the merit of first appreciating the value of Napier's invention, and who certainly did more than any other to spread the knowledge of it, and also to contribute to its perfection. Lilly, the astrologer, gives us, in his 'Memoirs,' a curious account of the intercourse between Briggs and Napier, to which the publication of the logarithmic calculus led. "I will acquaint you," he writes, "with one memorable story, related unto me by John Marr, an excellent mathematician and geometrician, whom I conceive you remember. He was servant to King James and Charles the First. At first, when the Lord Napier, of Marchiston, made public his logarithms, Mr. Briggs, then reader of the Astronomy Lectures at Gresham College, in London, was so surprised with admiration of them, that he could have no quietness in himself until he had seen that noble person, the Lord Marchiston, whose only invention they were; he acquaints John Marr herewith, who went into

Scotland before Mr. Briggs, purposely to be there when these two so learned persons should meet. Mr. Briggs appoints a certain day when to meet at Edinburgh; but failing thereof, the Lord Napier was doubtful he would not come. It happened, one day, as John Marr and the Lord Napier were speaking of Mr. Briggs; 'Ah, John,' said Marchiston, 'Mr. Briggs will not now come.' At the very instant, one knocks at the gate; John Marr hasted down, and it proved to be Mr. Briggs, to his great contentment. He brings Mr. Briggs up into my lord's chamber, where almost one quarter of an hour was spent, each beholding the other, almost with admiration, before one word was spoke. At last, Mr. Briggs began: 'My lord, I have undertaken this long journey, purposely to see your person, and to know by what engine of wit or ingenuity you came first to think of this most excellent help into astronomy, viz. the logarithms; but, my lord, being by you found out, I wonder nobody else found it out before, when now known it is so easy.' He was nobly entertained by the Lord Napier; and every summer after that, during the lord's being alive, this venerable man, Mr. Briggs, went purposely into Scotland to visit him."

Napier's discovery was very soon known over Europe, and was every where hailed with admiration, by men of science. The great Kepler, in particular, honored the author by the highest commendation, and dedicated to him his Ephemerides, for 1617. This illustrious astronomer, also, some years afterwards, rendered a most important service to the new calculus, by first demonstrating its principle on purely geometrical considerations. Napier's own demonstration, it is to be observed, though exceedingly ingenious, had failed to satisfy many of the mathematicians of that age, in consequence of its proceeding upon the supposition of the movement of a point along a line—a view analogous, as has been remarked, to that which Newton afterwards adopted, in the exposition of his doctrine of fluxions, but one of which no trace is to be found in the methods of the ancient geometers.

Napier did not expound the process by which he constructed his logarithms in his first publication. This ap-

peared only in a second work, published at Edinburgh, in 1619, after the death of the author, by his third son, Robert. In this work, also, the logarithmic tables appeared in the improved form in which, however, they had previously been published at London, by Mr. Briggs, in 1617. They have, since then, been printed in numberless editions, in every country of Europe. Nay, in the year 1721, a magnificent edition of them, in their most complete form, issued from the imperial press of Pekin, in China, in three volumes, folio, in the Chinese language and character. As for the invention, itself, its usefulness and value have grown with the progress of science; and, in addition to serving still as the grand instrument for the abridgement of calculation in almost every department in which figures are employed, it is now found to be applicable to several important cases, which could not be managed, at all, without its assistance. Some of the greatest names in the history of science, we may also remark, since Napier's time, have occupied themselves with the subject of the theory and construction of logarithms; and the labors of Newton, James Gregory, Halley, and Euler, have especially contributed to simplify and improve the methods for their investigation.

Napier, however, did not live long, to enjoy the reputation of his discovery, having died at Merchiston, on the 3d of April, 1617, in the sixty-eighth year of his age. That same year, he had published, at Edinburgh, a small treatise in Latin, of about one hundred and fifty pages, which he entitled, 'Rabdologiae seu Numerationis per Virgulas Libri Duo.' It contained an account of a method of performing the operations of multiplication and division, by means of a number of small rods, having the digits inscribed upon them, according to such an arrangement, that, when placed alongside of each other in the manner directed, in order, for instance, to multiply any two lines of figures, the several lines of the product presented themselves, and had only to be transcribed and added up to give the proper result. This was not, however, nearly so convenient a contrivance as that of logarithms, even for multiplication, and it was still less useful

in division; on which account, it has been supposed, that, although given to the world so late, it was probably an expedient, which had suggested itself to Napier for the abridgement of calculation, before his great invention. It has been thought, too, of so little practical utility, as, in all likelihood, never to have been actually employed for the purposes of calculation. A little tract, however, it may be remarked, appeared at London, so late as the year 1684, entitled 'Enneades Arithmeticæ,' containing, among other things, an account of "the Numbering Rods of the Right Honorable John, Lord Nepeer, enlarged;" and this work bears to be "printed for Joseph Moxon, at the sign of the Atlas in Ludgate street, *where also these numbering rods (commonly called Napier's bones) are made and sold.*" These rods, or bones, we may add, are what Butler alludes to in his Hudibras, where, in the account of the "rummaging of Sidrophel," he speaks of

> "A moon-dial, *with Napier's bones*,
> And several constellation stones,*
> Engraved in planetary hour,
> That over mortals had strange power."†

It was principally, as we have seen, with a view to the simplification of operations in trigonometry, that Napier proposed the logarithmic calculus. This was not the only improvement which he contributed to that branch of science. Among others, it owes to him a formula of great elegance and convenience, by which the solution of all the cases of spherical trigonometry is comprehended under a single rule. This, with several other new views in the same department of the mathematics, appeared for the first time in his second work on logarithms, published at Edinburgh, as we have already mentioned, in 1619.

* A correspondent informs us that he has seen at Gartness, the place before-mentioned, globular stones with the circles of the sphere and constellations engraven on them, and concave stones with engravings of a like character, said to have been made by Napier. They were certainly not of modern date, and one is built into the wall of a mill, where it is still to be seen.

† Part ii. canto 3, v. 1095. See also part iii. canto 2, v. 409. Professor Napier, of Edinburgh, who is descended from Lord Napier, is in possession of the set of bones used by his great ancestor

But his ingenious and contriving mind did not confine itself merely to speculative science, if we may believe the very curious statements which he makes with regard to some of his other inventions, in a paper with his signature, which is preserved among the manuscript collections of Anthony Bacon, (the brother of the Lord Chancellor Bacon,) in the archiepiscopal library, at Lambeth. This paper, which has of late years been several times printed,* is entitled, 'Secret Inventions, profitable and necessary in these days for the defence of this island, and withstanding of strangers, enemies to God's truth and religion.' Of these, the first is stated to be "a burning mirror for burning ships by the sun's beams," of which the author professes himself able to give to the world the "invention, proof, and perfect demonstrations, geometrical and algebraical, with an evident demonstration of their error who affirm this to be made a parabolic section." The second is a mirror for producing the same effect by the beams of a material fire. The third is a piece of artillery, contrived so as to send forth its shot, not in a single straight line, but in all directions, in such a manner as to destroy every thing in its neighborhood. Of this, the writer asserts that he can give "the invention and visible demonstration." The fourth and last of these formidable machines, is described to be "a round chariot in metal," constructed so as both to secure the complete safety of those within it, and, moving about in all directions, to break the enemy's array, "by continual charges and shot of the arquebuse through small holes." "These inventions," the paper concludes, "besides devices of sailing under the water, and divers other devices and stratagems for harassing of the enemies, by the grace of God and work of expert craftsmen, I hope to perform. John Napier, of Merchiston, anno dom. 1596, June 2."

From this date, it would appear, that Napier's head had been occupied with the contrivances here spoken of,

* In Dr. Anderson's Bee, vol. iii. p. 133,—in Lord Buchan's Life of Napier,—and in Tilloch's Philosophical Magazine, vol. xviii. pp. 53, &c. There is also a copy of it in the British Museum, among the MS. collections of Dr. Birch.

long before he made himself known by those scientific labors, by which he is now chiefly remembered; and, indeed, we might, perhaps, have inferred, even from the general nature of the inventions, and the object which the author avows he had in view by them, that they were the produce of that part of his life in which his apprehensions of the encroachments of popery contributed to animate his studies. Some of the announcements are certainly very extraordinary, and would almost lead us to suppose, that the writer, in this paper, rather intended to state what he conceived to be possible, than what he had himself actually performed. Yet, several of his expressions will not bear this interpretation; and there are not wanting other attestations, which go to confirm what he asserts, as to his having really constructed some of the machines he speaks of. There is a passage, in a strange work, entitled, 'The Jewel,' written by Sir Thomas Urquhart, and first published in 1652, which seems manifestly to allude to the third invention here enumerated. Sir Thomas, although certainly not the most veracious of authorities, would scarcely, one should think, have ventured to publish what we are now going to quote, only five and thirty years after Napier's death, if there had not been some foundation for his statement. His description may be sufficiently overcharged, (for he writes, it will be observed, in an extravagantly bombastic and hyperbolical strain,) without being altogether a fiction. After eulogizing Napier's mathematical learning, in very high-sounding terms, Sir Thomas proceeds to remark, that he deems him especially entitled to remembrance, on account of "an almost incomprehensible device, which, being in the mouths of the most of Scotland, and yet unknown to any that ever was in the world but himself, deserveth very well to be taken notice of in this place;"—"and," he adds, "it is this; he had the skill (as is commonly reported) to frame an engine, (for invention not much unlike that of Archytas's dove,) which, by virtue of some secret springs, inward resorts, with other implements and materials fit for the purpose, enclosed within the bowels thereof, had the power, if proportionable in bulk to the action

required of it, (for he could have made it of all sizes,) to clear a field, of four miles circumference, of all the living creatures exceeding a foot of height, that should be found thereon, how near soever they might be to one another; by which means, he made it appear, that he was able, with the help of this machine alone, to kill 30,000 Turks, without the hazard of one Christian. Of this, it is said that (upon a wager) he gave proof, upon a large plain in Scotland, to the destruction of a great many heads of cattle and flocks of sheep, whereof some were distant from other half a mile on all sides, and some a whole mile."*

It were to have been desired, certainly, that our author had been a little more particular in his description of the scene of this devastating exploit among the cattle; "a large plain in Scotland," being rather an unsatisfactory form of expression, even in reference to a country, where there are not a great many large plains; but this indefinite mode of writing is only Sir Thomas's usual style. We are not inclined, indeed, to put much faith in the rumor here recorded, that Napier actually put the power of his machine to the proof in the manner described; but the whole statement, taken in conjunction with what we have found the alleged inventor asserting, under his own hand, seems to put it beyond doubt that he had at least imagined some such contrivance, as that alluded to in the above passage, and even that his having done so was matter of general notoriety, in his own day, and for some time after. Sir Thomas Urquhart was born in 1613, some years before Napier's death, and his 'Jewel,' was first published in 1652. Napier, he informs us, when requested on his deathbed to reveal the secret of this engine of such extraordinary potency in the destruction of cattle, sheep, and Turks, refused to do so, on the score of there being too many instruments of mischief in the world, already, for it to be the business of any good man to add to the number.† This will remind the reader of the story

* 'The Discovery of a most rare Jewel,' &c., second edit. Edinburgh, 1774, pp. 57, 58.

† There is a common report, amongst the people at Gartness, that this machine is buried in the ground, near the site of the old castle said to have been occupied by Napier.

told respecting a machine, of somewhat similar pretensions, constructed at a later period, by the celebrated James Gregory, of which Sir Isaac Newton, when it was shown to him, is said to have expressed his disapprobation, on the same ground which Napier is here made to take. But the truth is, as has been often remarked, that the introduction of machines capable of producing the tremendous effects ascribed to those in question, would, in all probability, very soon put an end to war, which has not become more destructive, but the reverse, since the invention of a more formidable artillery than that anciently in use; and which, waged with such contrivances as those of Napier and Gregory, would certainly never be resorted to by nations as a mode of settling their differences, until they had become literally insane. Another consideration, however, which might suggest itself to a man of very scrupulous feelings on such a matter, is, that it would be unfair, for him to put even his native country in possession of an instrument, which would, in fact, give her an advantage in her disputes with the rest of the world, against which there would be no possibility of contending. If it put an end to war, which is one great evil, it would do so, by enabling a single nation to triumph over the prostration of the rest.

There appeared, some years ago, in one of our periodical works,* a very able and learned commentary on Napier's 'Secret Inventions,' the writer of which, has collected, with great industry, whatever notices the annals of science afford of achievements similar to those which the Scottish mathematician is asserted to have performed. In regard to the mirror, for setting objects on fire at a great distance, by the reflected rays of the sun, he adduces the wellknown story of the destruction of the fleet of Marcellus, at Syracuse, by the burning-glasses of Archimedes, and the other (not so often noticed) which the historian Zonaras records, of Proclus having consumed, by a similar apparatus, the ships of the Scythian leader Vitalian, when he besieged Constantinople, in the beginning of the

* Tilloch's Philosophical Magazine, vol. xviii. pp. 53—65, (published Feb. 1804.) See also p. 245, &c.

sixth century.* The possibility of such feats as these, was long disbelieved; but may be considered as having been fully demonstrated, by the experiments of modern times. Buffon, in particular, in the year 1747, by means of four hundred plane mirrors, actually melted lead and tin at a distance of fifty yards, and set fire to wood at a still greater. This, too, was in the months of March and April. With summer heat it was calculated that the same effects might have been produced at four hundred yards distance, or more than ten times that, to which, in all probability, Archimedes had to send his reflected rays. It may be concluded, therefore, that there is nothing absolutely incredible, in the account Napier gives of his first invention. His second announcement, however, is a good deal more startling; inasmuch as he here professes to have succeeded in an attempt, in which nobody else is recorded to have made any approach to success. Gunpowder has been lighted, by heat from charcoal, collected by one concave mirror and reflected from another; but no such effect has ever been produced by a single reflection of artificial heat. It is not very easy to comprehend the nature of the chariot, mentioned by Napier, as his fourth invention; but it seems to bear some resemblance, this writer remarks, to one of the famous Marquis of Worcester's contrivances. As for the device for sailing under water, noticed in the last paragraph of the paper, that exploit was performed in Napier's own day, by the Dutch chemist Cornelius Drebell, who is reported to have constructed a vessel for king James I., which he rowed under the water on the Thames. It carried twelve rowers, besides several passengers, the air breathed by whom, it is said, was made again respirable by means of a certain liquor, the composition of which, Boyle asserts, in one of his publications, that he knew, having been informed of it by the only person to whom it had been communicated by Drebell. Bishop Wilkins,

* Malala, another old chronicler, however, says that Proclus operated, on this occasion, not by burning-glasses, but by burning sulphur showered upon the ships from machines. *Vid.* Montucla, *Histoire des Mathématiques*, i. 334.

also, who lived very near the time at which it was performed, expressly mentions Drebell's experiment, in his 'Mathematical Magic.' Various successful essays in subaqueous navigation, have also been made in more recent times.

It is to be lamented, that the only one of Napier's inventions, the secret of which was solicited from him by his friends when he was leaving the world, should have been that which his conscience would not allow him to reveal, for the reason that has been stated. Had they asked him to explain to them his method of sailing under the water, for example, or even the construction of his burning mirrors, he probably would have had no excuse for withholding the information. But they seem to have been so anxious to get possession of the machine for destroying the thirty thousand Turks, that they had not a thought to spare for any of the other contrivances. The circumstance, however, of some of these inventions not having been rediscovered by any one else, since Napier's time, ought not, of itself, to be taken as conclusive evidence that his pretensions to a knowledge of them were mere dreams. Extraordinary as is the progress that science has made, within the last two centuries, during which period, the conquests she has effected, have been more numerous and wonderful than had been witnessed by all the previous centuries that had elapsed from the beginning of the world, there can be no doubt, that some of her apparently new inventions, have been only the forgotten discoveries of a preceding age revived, and also that there were some things known, in former times, which modern ingenuity has not yet recovered from oblivion. Such machines as those which Napier professes to have constructed, are exactly of the description least likely, for very obvious reasons, to occur to a modern speculator.*

* For a great deal of very curious information on the lost and revived inventions of antiquity, the reader may consult G. Pasch's learned work, entitled 'De Novis Inventis quorum accuratiori cultui facem praetulit antiquitas,' of which a second edition appeared at Leipsic in 1700; or Dutens's 'Récherches sur l'origine des decouvertes attribuées aux modernes,' first published in 1766, and lately, for the fourth time, in 1812. Of this last work, there is an English translation. See also Theod. Almelobeen's *Inventa Nov.-Antiqua.*

In that curious record, Birrell's Diary, which was published in Edinburgh, some years ago, we find, under date of the 23d October, 1598, the following notice: 'Ane proclamation of the Laird of Merkistoun, that he tuik upon hand to make the land mair profitable nor it wes before, be the sawing of salt upon it.' There can be little doubt, we think, that this was another scheme of the inventor of the logarithms; although the patent for the new mode of manuring, appears to have been taken out in the name of his eldest son, Archibald, who had been enfeofft in the fee of the barony, by his father, about a year before.* The patent, or gift of office, as it is called, was granted, upon condition that the patentee should publish an account of his method in print, which he did accordingly, shortly afterwards, under the title of 'The new order of gooding and manuring all sorts of field land with common salt.' This tract is now probably lost; but the facts that have been mentioned, are interesting, as establishing Napier's claim to an agricultural improvement which has been revived in our own day, and considered of great value.† The profits of the invention were probably given up to his son, who was, at this time, a young man of only twenty-five years of age, from the same disinterested feeling which had led his father previously to enfeoff him in his estate. Devoted to his books, Napier appears to have been very indifferent about money; and one of his contemporaries‡ even goes so far as to assert, that he dissipated his fortune by his experiments. Of this, however, there is no evidence; and the truth, in all likelihood, is merely that he bestowed but little attention upon his pecuniary concerns, occupied as his whole mind was about other matters. But if he suggested this method of manuring with salt, he must be allowed to have directed his speculations occasionally to

* See Records of Privy Council for 22d June, 1598, quoted in Douglas's Peerage, by Wood, ii. 292.

† See Parkes, on 'The advantages of using Salt.'

‡ Thomas Dempster, a man of unquestionable learning and genius, but by no means to be always depended upon in what he states upon his own authority.

the improvement of the arts of common life, as well as to that of the abstract sciences.

Napier died on the 3d of April, 1617. He was twice married, and had twelve children, of whom Archibald, the eldest, mentioned above, was raised to the peerage, by the title of Lord Napier, in 1627. A small volume of 'Memoirs' of this person, written by himself, was published in 1793. The second part of Napier's explanation of his Logarithms was published by his third son, Robert, from his father's papers, in 1619. There are said to be still in the possession of the family, some productions of their distinguished ancestor, on scientific subjects, which have not been printed, especially, a treatise, in English, on Arithmetic and Algebra, and another, on Algebra, in Latin.*

The life, which we have thus sketched, may be considered as affording us an eminent example of the manner in which the many advantages enjoyed by the wealthy may be turned to account, in the pursuit of learning and philosophy. A good education, access to all the best means of improvement, uninterrupted leisure, comparative freedom from the ordinary anxieties of life, the means of engaging in inquiries and experiments, the expense of which cannot be afforded by the generality of students, —the possession of all these things, to the mind that knows how to profit by them, is indeed invaluable. We have seen what they produced, in Napier's case. In dedicating his time and his fortune, to pursuits so much nobler than those that have usually occupied persons of his station, this illustrious individual had his ample reward. We can scarcely doubt that he led a happier life, in his studious retirement, in the midst of his books and his experiments, than if he had given himself either to the ordinary pleasures of the world, or to the hazards and vexations of political ambition. The more useful and more honorable path, he certainly chose. By his great and fortunate discovery, he made the science of all succeeding times his debtor, and constituted himself the benefactor of every generation of posterity. And then, for

* Douglas's Peerage, by Wood, ii. 290.

fame, which our very nature has made dear to us, that, too, this philosopher found in his closet of meditation. Even in his own day, his renown was spread abroad over Europe, and he was greeted with the publicly expressed admiration of some of the most distinguished of his contemporaries; and the time that has since elapsed, has only served to throw an increasing light around his name, which is now sure to retain its distinction so long as the sciences which he loved shall continue to be cultivated among men.

CHAPTER IV.

Drummond, of Hawthornden; Tycho Brahe; Tschirnhausen; Boyle,—The Air-pump, and Air;—Cavendish. NOTE.

IT would be easy to add, to that of Napier, a long list of other names, of men of wealth and rank, who, in like manner, have devoted themselves to science or literature, in preference to all other pursuits. But we have space to mention only a very few. One name, which Napier's naturally suggests to us, is that of his contemporary and countryman, WILLIAM DRUMMOND, of Hawthornden, one of the most elegant poetical writers of the early part of the seventeenth century. Drummond and Napier were neighbors, but probably no record has been preserved, of any intercourse between the mathematician and the poet. As the former, however, was resorted to, every year, by his scientific English friend, Mr. Briggs; so the latter, also, had his visiter from the south, who came to pay his respects to him, from admiration of his kindred genius. In the year 1616, the famous Ben Jonson walked all the way from London to Hawthornden, to see his brother poet, and remained, for some time, as his guest. Of this visit, a curious account is preserved,

written by Drummond, himself, which has been often printed. Drummond, who was distinguished for his learning, as well as his poetry, died in 1649, in his sixty-fourth year, having lived through a very agitated period, without mixing in its political convulsions, satisfied with philosophy and the muses.

Another contemporary of Napier, whose labors and speculations were more similar to his own, was the celebrated Danish astronomer, TYCHO BRAHE. Brahe's family was both wealthy and noble; but when he first manifested his attachment to the science, in which he afterwards acquired so much reputation, being then only a boy at school, his friends did every thing they could, to check an inclination, which they deemed quite unsuited to his birth and prospects; and the young astronomer was obliged to conceal from his tutor the mathematical books, which he purchased with his pocket-money, and to read them, as well as to make his observations on the stars, in hours stolen from the time allowed him for sleep. For, even before he was sixteen, he had begun to measure the distances of the heavenly bodies from one another, although he had no better instrument than a common pair of compasses, the hinge of which he used to put to his eye, while he opened the legs until they pointed to the two stars, whose relative position he wished to ascertain. A collection of celestial observations, made by him, at this early period, is still preserved at Copenhagen.

When he became of age, however, and was his own master, his fortune enabled him to choose his own pursuits; and having first spent some years in travelling through Germany and Switzerland, and visiting the observatories in these countries, he then returned home, took up his residence on his estate, and dedicated himself, almost entirely, to his favorite science. Some of the results of his studies, which he published, soon drew to him the attention of the learned among his countrymen; and at the desire of the king, he at last left his retreat, to teach astronomy in the capital. But the constant interruptions, to which he was here exposed, disgusted him with a town life; and he sighed to get once more back to

his country retirement. All his wishes in this respect were at length gratified, by an act of extraordinary munificence on the part of his royal master, who bestowed on him the island of Hueen, in the Sound, together with a pension of five hundred crowns, a lordship in Norway, and an ecclesiastical benefice, which brought him two thousand crowns more, in order that, with these revenues, added to those of his original estates, he might be enabled to prosecute his celestial observations on the grandest scale.

In this island, accordingly, Brahe now took up his abode, and soon erected on it a splendid observatory, provided with all the best instruments known in that age. He spent, he says, a hundred thousand crowns of his own money upon its completion, in addition to the produce of his grants from the king. Here he resided, for seventeen years, during the whole of which time he continued to devote himself, with unabated zeal, to his scientific pursuits. But such was now his fame, that even in this retirement, besides being surrounded, as before, by pupils who crowded to profit by his instructions, he was sought out by many visiters, both from his own and foreign countries.

Among other persons of distinction, who came to see him, was James I., of England, then king of Scotland, who passed a week with him in the year 1590; but, if the story that is told, be true, this visit was any thing, rather than a fortunate incident for Brahe. Some years afterwards, it is said, his protector, Frederick II., being dead, he was visited, one day, by the young king, Christian IV., accompanied by his chief minister, Walckendorf; and it so happened, that this latter personage, who was very sensitive and choleric, was barked at, as he approached the house, by two dogs belonging to the astronomer, at which he chose to be so much offended, that he went up to the animals, and beat them severely. The dogs had been presented to Brahe, by the Scottish monarch; and irritated at seeing them ill-treated, he interfered, to prevent the enraged senator from continuing his chastisement. This gave rise to some high words between the two, and the result was a quarrel, which Walckendorf,

at least, never forgot. From that day, Brahe's ruin was resolved upon by his powerful enemy. A commission was soon after appointed to report upon the public utility of his establishment; and upon this compliant body declaring that they saw nothing in his splendid observatory, but a source of useless expense to the state, a decree was passed, recalling all the grants he had received from the former king, and dispossessing him of his island. On this, Brahe determined to bid adieu, for ever, to his ungrateful country; and, taking with him all his instruments, he retired to Germany.

About two years afterwards, however, he was invited to take up his residence at Prague, by the Emperor, Rodolph II.; and by this prince, who was warmly attached to science, he was provided with a second asylum, almost as splendid as that, which he had enjoyed in his native country. But he lived only a very short time, after this, having died in 1601, in the fifty-fifth year of his age.

Tycho Brahe, as most of our readers are probably aware, was the inventor, or reviver, of a peculiar scheme of the universe, according to which, the earth is conceived to be immovable in the centre of the system, the sun to revolve round it, and the other planets round the sun. It is unnecessary to say, that this hypothesis has been long exploded. Indeed, even at the time when it was proposed by its author, it was, although supported by him with much ingenuity, a most unphilosophical retrogression from the true system, previously established by Copernicus. But, although Brahe, it thus appears, has no very high claims upon our admiration as a theorist, he undoubtedly did much, in another way, to promote the improvement of astronomy. His extraordinary devotion to the science, of itself, operated as inspiration, upon many of the other ardent minds of the time. But it was by the great number and comparative exactness of his observations, far surpassing any thing that had been attained by his predecessors, that he chiefly contributed to the progress of astronomy. No other but one in his circumstances, could have commanded either the leisure or the pecuniary means necessary for the making of these obser-

vations, which, besides having occupied many years, owed much of their superior accuracy to the excellence and consequent costliness of the instruments which Brahe employed. Here, therefore, was a case in which science was indebted to the wealth of one of its cultivators for services, which no zeal or talents could have otherwise enabled him to render.

Another man of fortune, to whom both science and the arts are under considerable obligations, is the German mathematician, TSCHIRNHAUSEN, celebrated for the discovery of the peculiar curve called, after him, Tschirnhausen's Caustics. He was born in 1651, at the seat of his ancestors, in Upper Lusatia ; and although, after receiving an excellent education, he entered the army at an early age, he very soon quitted the profession of a soldier, and set out on his travels, through England, Italy, and France. He spent several years in traversing these countries, embracing every opportunity of obtaining a knowledge of their arts, manufactures, and productions, and seeking the acquaintance of the learned men of the time, wherever he went.

On returning home, he took up his residence on his estate, the revenues of which were ample ; and the remainder of his life was given to scientific speculations and experiments. The science of optics was that, to which he was chiefly attached ; and it was while making some experiments with reflecting mirrors, that he discovered his Caustics, which are curves formed by light reflected in certain circumstances, and are so called from the Greek word for a burning-glass. They possess some remarkable geometrical properties.* When Tschirnhausen announced this discovery, to the French Academy of Sciences, he was only in his thirty-first year ; but he was immediately admitted a member of the Academy, by order of the king, Louis XIV.

* In an article of some length, upon Tschirnhausen, in the *Biographie Universelle*, the writer, M. Gley, by a strange blunder, mistakes these curves for actual burning-glasses ; and describes, with great minuteness, their wonderful powers in kindling and consuming, or melting, wood, iron, tiles, slates, and earthenware !—Vide *Biog. Univ.* xlvii. 3.

In order to have the aid of proper instruments, in the prosecution of his researches, he afterwards established three glass-houses in his native district; at which he employed all the resources of his ingenuity in endeavoring to fabricate burning-glasses of greater size and power than any which had ever been elsewhere produced. In 1687, he had made a concave reflecting mirror, of copper, of the diameter of four feet and a half, which consumed wood and fused metals at twelve feet distance in a few seconds; but, although these effects greatly surpassed any thing of the same kind that had been accomplished in modern times, he found the inconvenience of operating by reflection so great, that he determined to persevere in his attempts to obtain, if possible, a lens of equal magnitude. He did not exactly attain this object; for the largest lens, he succeeded in producing, had only a diameter of three feet. But when it is added, that no one but himself had ever before made one of more than four or five inches diameter, his success will probably be deemed sufficiently extraordinary. The method he employed in fabricating this immense glass, is not known. It was convex on both sides, and weighed a hundred and sixty pounds. Although somewhat less in size, its effects greatly exceeded those of the reflector he had formerly used. This lens was purchased from Tschirnhausen, by the Duke of Orleans, who afterwards made a present of it to the Academy of Sciences.

Tschirnhausen deserves, also, to be remembered, as the founder of the celebrated porcelain manufactory, of Dresden. Before his time, it was supposed, that the Chinese employed, for their porcelain, a peculiar earth, only found in their own country; but he discovered that the same species of ware could be manufactured from a compound of different sorts of earth, which might be obtained in Europe, as well as in China. This eminent benefactor to the arts, who, besides his contributions to the 'Transactions of the French Academy,' was also the author of two separate works,—the first, entitled, 'The Medicine of the Body,' the latter, 'The Medicine of the Mind,' being, in fact, a system of the art of reasoning,—died in 1708.

But, perhaps, the best example we can adduce of the manner in which wealth may be made subservient, by its possessor, not only to the acquisition of knowledge, but also to its diffusion and improvement, is that of the Honorable ROBERT BOYLE. Boyle was born at Lismore, in Ireland, in 1627, and was the seventh and youngest son of Richard, the first Earl of Cork, and commonly called the Great Earl. The first advantage which he derived from the wealth and station of his father, was an excellent education. After having enjoyed the instructions of a domestic tutor, he was sent, at an early age, to Eton. But his inclination, from the first, seems to have led him to the study of things, rather than of words. He remained at Eton only four years, "in the last of which," according to his own statement, in an account which he has given us of his early life, "he forgot much of that Latin he had got, for he was so addicted to more solid parts of knowledge, that he hated the study of bare words, naturally, as something that relished too much of pedantry, to consort with his disposition and designs."

In reference to what is here insinuated, in disparagement of the study of languages, merely as such, we may just remark, that the observation is, perhaps, not quite so profound, as it is plausible. So long as one mind differs from another, there will always be much difference of sentiment, as to the comparative claims upon our regard, of that, on the one hand, which addresses itself principally to the taste or the imagination, and that, on the other, which makes its appeal to the understanding, only. But it is, at any rate, to be remembered, that, in confining the epithet useful, as is commonly done, to the latter, it is intended to describe it as the useful, only pre-eminently, and not exclusively. The agreeable or the graceful is plainly also useful. The study of language and style, therefore, cannot, with any propriety, be denounced as a mere waste of time; but, on the contrary, is well fitted to become to the mind a source both of enjoyment and of power. So great, indeed, is the influence of diction upon the common feelings of mankind, that no literary work, it may be safely asserted, has ever acquired

a permanent reputation and popularity, or, in other words, produced any wide and enduring effect, which was not distinguished by the graces of its style. Their deficiency, in this respect, has been at least one of the causes of the comparative oblivion, into which Mr. Boyle's own writings have fallen, and doubtless, weakened the efficacy of such of them as aimed at any thing beyond a bare statement of facts, even in his own day. It was this, especially, which exposed some of his moral lucubrations, to Swift's annihilating ridicule.

On being brought home from Eton, Boyle, who was his father's favorite son, was placed under the care of a neighboring clergyman, who, instructing him, he says, "both with care and civility, soon brought him to renew his first acquaintance with the Roman tongue, and to improve it so far that in that language he could readily enough express himself in prose, and began to be no dull proficient in the poetic strain." "Although, however," he adds, "naturally addicted to poetry, he forbore, in afterlife, to cultivate his talent for that species of composition, because, in his travels, having, by discontinuance, forgot much of the Latin tongue, he afterwards never could find time to redeem his losses, by a serious study of the ancient poets." From all this, it is evident that the natural bent of his mind did not incline him very strongly to classical studies; and as, for the most obviously wise purposes, there has been established among men a diversity of intellectual endowments and tendencies, and every mind is most efficient when it is employed most in accordance with its natural dispositions and predilections, it was just as well that the course of his education was now changed.

In his eleventh year, he and one of his brothers were put under the charge of a Mr. Marcombes, a French gentleman, and sent to travel on the Continent. In the narrative of his early life, in which he designates himself by the name of Philoretus, Mr. Boyle has left us an account of his travelling tutor. "He was a man," says he, "whose gait, his mien, and outside, had very much of his nation, having been divers years a traveller and a

soldier ; he was well fashioned, and very well knew what belonged to a gentleman. His natural were much better than his acquired parts, though divers of the latter he possessed, though not in an eminent, yet in a competent degree. Scholarship he wanted not, having, in his greener years, been a professed student in divinity ; but he was much less read in books than men, and hated pedantry as much as any of the seven deadly sins. * * * Before company he was always very civil to his pupils, apt to eclipse their failings, and set off their good qualities to the best advantage. But in his private conversation, he was cynically disposed, and a very nice critic both of words and men ; which humor he used to exercise so freely with Philoretus, that at last he forced him to a very cautious and considerate way of expressing himself, which after turned to his no small advantage. The worst quality he had, was his choler, to excesses of which, he was excessively prone ; and that being the only passion to which Philoretus was much observed to be inclined, his desire to shun clashing with his governor, and his accustomedness to bear the sudden sallies of his impetuous humor, taught our youth so to subdue that passion in himself, that he was soon able to govern it habitually and with ease."

Under the guidance of this gentleman, who, although not much fitted, apparently, to make his pupils profound scholars, or even to imbue them with a taste for elegant literature, was probably very well qualified both to direct their powers of observation, and to superintend and assist the general growth of their minds, at this early age, the two brothers passed through France to Geneva, where they continued some time, studying rhetoric, logic, mathematics, and political geography, to which were added the accomplishments of fencing and dancing. " His recreations during his stay at Geneva," says Mr. Boyle of himself, " were sometimes mall, tennis, (a sport he ever passionately loved,) and, above all, the reading of romances, whose perusal did not only extremely divert him, but (assisted by a total discontinuance of the English tongue) in a short time taught him a skill in French, somewhat unusual to strangers." The party afterwards set off for

Italy, and, after visiting Venice and other places, proceeded to Florence, where they spent the winter.

While residing here, Mr. Boyle made himself master of the Italian language. But another acquisition, for which he was indebted to his visit to Florence, probably influenced to a greater extent the future course of his pursuits; we mean the knowledge he obtained of the then recent astronomical discoveries of Galileo. This great philosopher died in the neighborhood of Florence, in the beginning of the year 1642, while Boyle and his brother were pursuing their studies in that city. The young Englishman, who was himself destined to acquire so high a reputation by his experiments in various departments of physical science, some of them the same which Galileo had cultivated, probably never even beheld his illustrious precursor; but we cannot tell how much of Boyle's love of experimental inquiry, and his ambition to distinguish himself in that field, may have been caught from this, his accidental residence in early life, in a place, where the renown of Galileo and his discoveries must have been on the lips of all.

Boyle returned to England, in 1644. Although he was yet only in his eighteenth year, he seems to have thought that his education had been long enough under the direction of others, and he resolved, therefore, for the future, to be his own instructer. Accordingly, his father being dead, he retired to an estate, which had been left him, in Dorsetshire, and gave himself up, we are told, for five years, to the study principally of natural philosophy and chemistry. His literary and moral studies, however, it would appear, were not altogether suspended during this time. In a letter, written by him from his retirement, to his old tutor, Mr. Marcombes, we find him mentioning, as also among his occupations, the composing of essays in prose and verse, and the study of ethics, "wherein," says he, "of late, I have been very conversant, and desirous to call them from the brain down into the breast, and from the school to the house."

These details do not, like many of those we have given, in former parts of our work, exhibit to us the ardent

lover of knowledge, beset with impediments at every step, in his pursuit of the object on which he has placed his affections, and having little or nothing to sustain him under the struggle, except the unconquerable strength of the passion with which his heart is filled. On the contrary, we have here, a young man, who has enjoyed, from his birth, upwards, every facility for the improvement of his mind, and is now surrounded with all the conveniences he could desire, for a life of the most various and excursive study. A happy and enviable lot! Yet, by how few of those, to whom it has been granted, as well as to him of whom we are now speaking, have its advantages been used, as they were by him! The truth is, that if the mind be not in love with knowledge, no mere outward advantages will enable any one to make much progress in the pursuit of it; while, with this love for it, all the difficulties, which the unkindness of fortune can throw in the way of its acquisition, may be overcome. The examples we have already recorded, of many a successful struggle with such difficulties, in their most collected and formidable strength, sufficiently warrant us to hold out this encouragement to all.

In the same letter to Mr. Marcombes, which we have just quoted, we find Boyle making mention, for the first time, of what he calls "our new Philosophical or Invisible College," some of the leading members of which, he informs his correspondent, occasionally honored him with their company at his house. By this *Invisible College*, he undoubtedly means that association of learned individuals, who began, about this period, to assemble together, in London, for the purposes of scientific discussion, and whose meetings formed the germ of the Royal Society. According to the account given in a letter, written many years after, by Dr. Wallis, another member of the club, to his friend, Dr. Thomas Smith, it appears that these meetings first began to be held in London, on a certain day in every week, about the year 1645. Mr. Boyle's name does not occur in the list of original members, given by Dr. Wallis; but he professes to mention only several of the number. There can be no doubt, that Boyle

joined them, soon after the formation of the association. According to Dr. Wallis, the meetings were first suggested by a Mr. Theodore Haak, whom he describes as a German of the Palatinate, then resident in London. They used to be held, sometimes, in Wood street, at the house of Dr. Goddard, the eminent physician, who kept an operator for grinding glasses for telescopes and microscopes; sometimes, at another house, in Cheapside; and sometimes, in Gresham College, to which several of the members were attached. The subjects of inquiry and discussion are stated to have embraced every thing relating to "physic, anatomy, geometry, astronomy, navigation, magnetics, chemics, mechanics, and natural experiments," whatever, in short, belonged to what was then called "the new or experimental philosophy."

In course of time, several of the members of the association were removed to Oxford; and they began, at last, to meet by themselves in that city, while the others continued their meetings in London. The Oxford meetings began to be regularly held, about the year 1649. In 1654, Mr. Boyle took up his residence at Oxford, probably induced, in great part, by the circumstance of so many of his philosophical friends being now there, and engaged together in the same inquiries with himself. The Oxford associates, according to Dr. Wallis, met first in the apartments of Dr. Petty, (afterwards the celebrated Sir William Petty, the ancestor of the Marquis of Lansdowne,) who lodged, it seems, in the house of an apothecary, whose store of drugs was found convenient for their experiments. On Dr. Petty going to Ireland, they next met, the narrative proceeds, "(though not so contantly,) at the lodgings of Dr. Wilkins, then warden of Wadham College; and, after his removal to Trinity College in Cambridge, at the lodgings of the Honorable Mr. Robert Boyle, then resident for divers years in Oxford." Boyle, indeed, continued to reside in this city, till the year 1668. Meanwhile, in 1663, three years after the Restoration, the members of the London club were incorporated under the title of the Royal Society.

It was during his residence at Oxford, that Boyle made

some of the principal discoveries with which his name is connected. In particular, it was here that he prosecuted those experiments upon the mechanical properties of the air, by which he first made himself generally known to the public, and the results of which rank among the most important of his contributions to natural science. The first account, which he published, of these experiments, appeared at Oxford, in 1660, under the title of 'New Experiments Physico-Mechanical, touching the spring of the air and its effects.' The work is in the form of letters to his nephew, Viscount Dungarvon, the son of the Earl of Cork, which are dated in December, 1659. It may be not unnaturally supposed, that Boyle's attention was first directed to the subject of Pneumatics, when he was engaged at Florence, in making himself acquainted with the discoveries of Galileo, whose experiments first introduced any thing like science into that department of inquiry. He states, himself, in his first letter to his nephew, that he had some years before heard of a book, by the Jesuit Schottus, giving an account of a contrivance, by which, Otto Guericke, consul of Magdeburg, had succeeded in emptying glass vessels of their contained air, by sucking it out at the mouth of a vessel, plunged under water. He alludes here to Guericke's famous invention of the instrument now commonly called the air-pump. This ingenious and ardent cultivator of science, who was born in Magdeburg, in Saxony, in the beginning of the seventeenth century, in his original attempts to produce a vacuum, used first to fill his vessel with water, which he then sucked out by a common pump, taking care, of course, that no air entered to replace the liquid.

This method was probably suggested to Guericke, by Torricelli's beautiful experiment with the barometrical tube,* the vacuum produced in the upper part of which, by the descent of the mercury, has been called, from him, the Torricellian vacuum. It was by first filling it with water, that Guericke expelled the air from the copper globe, the two closely-fitting hemispheres comprising which, six horses were then unable to pull asunder,

* Mentioned in the former volume, p. 20.

although held together by nothing more than the pressure of the external atmosphere. This curious proof of the force, or weight of the air, which was exhibited before the Emperor Ferdinand III., in 1654, is commonly referred to by the name of the experiment of the Magdeburg hemispheres.

Guericke, however, afterwards adopted another method of exhausting a vessel of its contained air, which could be applied more generally than the one he had first employed. This consisted in at once. pumping the air itself. The principle of the contrivance which he used for that purpose, will be understood, from the following explanation. If we suppose a barrel, of perfectly equal bore, throughout, and having in it a closely-fitting plug or piston, to have been inserted in the mouth of the vessel, it is evident that, when this piston was drawn up from the bottom to the top of the barrel, it would carry along with it all the air that had previously filled the space through which it had passed. Now, were air, like water, possessed of little or no expansive force, this space, after being thus deprived of its contents, would have remained empty, and there would have been an end of the experiment. But in consequence of the extraordinary elasticity of the element in question, no sooner would its original air be lifted by the piston out of the barrel, than a portion of that in the vessel, beyond the piston, would flow out to occupy its place. The vessel and the barrel, together, would now, therefore, be filled by the same quantity of air which had originally been contained in the first alone, and which would consequently be diminished in density just in proportion to the enlargement of the space which it occupied. But although so much of the air to be extracted had thus got again into the barrel, there would still, at this point, have been an end of the experiment, if no way could have been found of pushing back the piston, for another draught, without forcing also the air beyond it, into the vessel again, and thus merely restoring matters to the state in which they were at the commencement of the operation. But here, Guericke was provided with an ingenious contrivance;—that of the valve: the idea of applying which, he borrow-

ed, no doubt, from the common water-pump, in which it had been long used. A valve, which, simple as it is, is one of the most useful and indeed indispensable of mechanical contrivances, is, as most persons know, merely a flap, or lid, moving on a hinge, which, covering an orifice, closes it, of course, against whatever attempts to pass through from behind itself, (a force bearing upon it from thence evidently only shutting it closer,) while it gives way to and permits the passage of whatever comes in the opposite direction. Now Guericke, in his machine, had two of these valves, one covering a hole in the piston, another covering the mouth of the vessel where the barrel was inserted; and both opening outwards. In consequence of this arrangement, when the piston, after having been drawn out, as we have already described, was again pushed back, the air in the barrel was prevented from getting back into the vessel, by the further valve, now shut against it, while it was, at the same time, provided with an easy means of escape by the other, through which, accordingly, it passed away. Here, then, was one barrel-full of the air in the vessel, dislodged; and the same process had only to be repeated, a sufficient number of times, in order to extract as much more as was desired. The quantity, however, removed every time was, of course, always becoming less; for, although it filled the same space, it was more attenuated.

The principle, therefore, upon which the first air-pump was constructed, was the expansibility of the air, which the inventor was enabled to take advantage of through means of the valve. These two things, in fact, constitute the air-pump; and whatever improvements have been since introduced in the construction of the machine have gone only to make the working of it more convenient and effective. In this latter respect, the defects of Guericke's apparatus, as might be expected, were considerable. Among others, with which it was chargeable, it required the continual labor of two men, for several hours, at the pump, to exhaust the air from a vessel of only moderate size; the precautions which Guericke used, to prevent the intrusion of air from without, between

the piston and the sides of the barrel, during the working of the machine, were both imperfect for that purpose, and greatly added to the difficulties and incommodiousness of the operation; and, above all, from the vessel employed being a round globe, without any other mouth or opening than the narrow one in which the pump was inserted, things could not be conveyed into it, nor, consequently, any experiments made, in that vacuum which had been obtained. Boyle, who says that he had himself thought of something like an air-pump before he heard of Guericke's invention, applied himself, in the first place, to the remedying of these defects in the original instrument, and succeeded in rendering it considerably more convenient and useful. At the time when he began to give his attention to this subject, he had Robert Hooke, who afterwards attained a distinguished name in science, residing with him, as an assistant in his experiments; and it was Hooke, he says, who suggested to him the first improvements in Guericke's machine. These, which could not easily be made intelligible by any mere description, and which, besides, have long since given way to still more commodious modifications of the apparatus, so that they possess now but little interest, enabled Boyle and his friends to carry their experiments with the new instrument much further than had been done by the consul of Magdeburg. But, indeed, Boyle himself did not long continue to use the air-pump which he describes in this first publication. In the second part of his 'Physico-Mechanical Experiments,' he describes one of a new construction; and, in the third part of the same work, one still further improved. This last, which is supposed to have been also of Hooke's contrivance, had two barrels, moved by the same pinion-wheel, which depressed the one, while it elevated the other, and thus did twice as much work as before, in the same time. The air-pump has been greatly improved, since the time of Boyle, by the Abbé Nollet, Gravesande, Smeaton, Prince, Cuthbertson, and others.

By his experiments with this machine, Boyle made several important discoveries with regard to the air, the

principle of which he details in the three successive parts of the work we have mentioned. Having given so commodious a form and position to the vessel, out of which the air was to be extracted, (which, after him, has been generally called the receiver, a name, he says, first bestowed upon it by the glassmen,) that he could easily introduce into it any thing which he wished to make the subject of an experiment, he found that neither flame would burn, nor animals live, in a vacuum, and hence he inferred the necessity of the presence of air, both to combustion and animal life. Even a fish, immersed in water, he proved, would not live in an exhausted receiver. Flame and animal life, he showed, were also both soon extinguished in any confined portion of air, however dense, although not so soon in a given bulk of dense as of rarefied air; nor was this, as had been supposed, owing to any exhalation of heat from the animal body or the flame, for the same thing took place, when they were kept in the most intense cold, by being surrounded with a frigorific mixture. What he chiefly sought to demonstrate, however, by the air-pump was, the extraordinary elasticity, or spring, as he called it, of the air.

It is evident, from the account that has been given of the principle of this machine, that, if the pump be worked ever so long, it never can produce in the receiver a strictly perfect vacuum: for the air expelled from the barrel, by the last descent of the piston, must always be merely a portion of a certain quantity, the rest of which, will be in the receiver. The receiver, in truth, after the last stroke of the piston, is as full of air as it was at first; only that, by which it is now filled, is so much rarefied and reduced in quantity, although it occupies the same space as before, that it may be considered as, for most practical purposes, annihilated. Still, a certain quantity, as we have said, remains, be it ever so small; and this quantity continues, just as at first, to be diffused over the whole space within the receiver. From this circumstance, Boyle deduced some striking evidences of what seems to be the almost indefinite expansibility of the air. He at last actually dilated a portion of air, to

such a degree, that it filled, he calculated, 13,679 times its natural space, or that which it occupied as part of the common atmosphere.

But the usual density of the atmosphere is very far from being the greatest to which the air may be raised. It is evident that, if the two valves of the air-pump we have already described be made to open inwards instead of outwards, the effect of every stroke of the piston will be, not to extract air from the receiver, but to force an additional quantity into it. In that form, accordingly, the machine is called a forcing-pump, and is used for the purpose of condensing air, or compressing a quantity of it into the smallest possible space. Boyle succeeded, by this method, in forcing into his receiver forty times its natural quantity. But the condensation of the air has been carried much further since his time. Dr. Hales compressed into a certain space, 1522 times the natural quantity, which, in this state, had nearly twice the density, or, in other words, was nearly twice as heavy, as the same bulk of water. Of the air thus condensed by Dr. Hales, therefore, the same space actually contained above twenty millions of times the quantity which it would have done, of that dilated to the highest degree by Mr. Boyle. How far do these experiments carry us beyond the knowledge of Aristotle, who held that the air, if rarefied so as to fill ten times its usual space, would become fire!

We have dwelt the longer upon these details, both as referring to some of the most important contributions for which science is indebted to Mr. Boyle, and because they serve to continue the brief sketch of discoveries relating to the air, which we gave in our former volume.* On leaving Oxford, in 1668, Boyle came to London, and here he continued to reside, during the remainder of his life. Up to this time, his attendance at the meetings of the Royal Society had been only occasional, but he was now seldom absent. Science, indeed, was as much the occupation of his life, as if it had been literally his business or profession. No temptations could seduce him away from his philosophical pursuits. Belonging, as he

* See vol. i. p. 19, &c.

did, to one of the most powerful families in the kingdom, —having no fewer than four brothers in the Irish peerage, and one in the English,—the highest honors of the state were open to his ambition if he would have accepted of them. But so pure was his love of science and learning, and, with all his acquirements, so great his modesty, that he steadily declined even those worldly distinctions which might be said to lie strictly within the sphere of his pursuits. He was zealously attached to the cause of religion, in support of which, he wrote and published several treatises; but he would not enter the Church, although pressed to do so by the king, or even accept of any office in the Universities, under the conviction that he should more effectually serve the interests both of religion and learning, by avoiding every thing which might give him the appearance of being their hired or interested advocate. He preferred other modes of showing his attachment, in which his wealth and station enabled him to do what was not in the power of others. He allowed himself to be placed at the head of associations for the prosecution of those objects which he had so much at heart; he contributed to them his time, his exertions, and his money; he printed, at his own expense, several editions of the Scriptures, in foreign languages, for gratuitous distribution; if learned men were in pecuniary difficulties, his purse was open to their relief. And as for his own labors, no pay could have made them more zealous or more incessant.

From his boyhood till his death, he may be said to have been almost constantly occupied in making philosophical experiments; collecting and ascertaining facts in natural science; inventing or improving instruments for the examination of nature; maintaining a regular correspondence with scientific men in all parts of Europe; receiving the daily visits of great numbers of the learned, both of his own and other countries; perusing and studying not only all the new works that appeared in the large and rapidly-widening department of natural history and mathematical and experimental physics, including medicine, anatomy, chemistry, geography, &c., but many others relating especially to theology and Oriental literature; and, lastly,

writing so profusely upon all these subjects, that those of his works, alone, which have been preserved and collected, independently of many others that are lost, fill, in one edition, six large quarto volumes. So vast an amount of literary performance, from a man who was at the same time so much of a public character, and gave so considerable a portion of his time to the service of others, shows, strikingly, what may be done by industry, perseverance, and such a method of life as never suffers an hour of the day to run to waste.

In this last particular, indeed, the example of Mr. Boyle well deserves to be added to those of the other great men we have already mentioned. Of his time, he was, from his earliest years, the most rigid economist, and he preserved that good habit to the last. Dr. Dent, in a letter to Dr. Wotton, tells us, that "his brother, afterwards Lord Shannon, (who accompanied him on his continental tour with Mr. Marcombes,) used to say, that, even then, he would never lose any vacant time; for, if they were upon the road, and walking down a hill, or in a rough way, he would read all the way; and when they came, at night, to their inn, he would still be studying till supper, and frequently propose such difficulties, as he met with in his reading, to his governor." The following artless statement, too, which we find in an unfinished essay on a theological subject, which he left behind him in manuscript, and of which Dr. Birch, the editor of his collected works, has printed a part, may serve to show the diligence with which he prosecuted his severer studies, even amidst all sorts of interruptions. "It is true," he writes, "that a solid knowledge of that mysterious language" (it is his acquisition of the Hebrew tongue to which he refers) "is somewhat difficult, but not so difficult, but that so slow a proficient as I, could in less than a year, of which not the least part was usurped by frequent sicknesses and journeys, by furnaces, and by (which is none of the modestest thieves of time) the conversation of young ladies, make a not inconsiderable progress towards the understanding of both Testaments in both their originals."

But the life of active and incessant occupation which

he led, even in his declining years, is best depicted in another curious document, which Dr. Birch has preserved. A few years before his death, he was urged to accept the office of President of the Royal Society, of which he had so long been one of the most active and valuable members, and the Transactions of which, he had enriched by many papers of great interest; but he declined the honor, on the score of his growing infirmities. About this time, he also published an advertisement, addressed to his friends and acquaintances, in which he begins, by remarking, "that he has, by some unlucky accidents, had many of his writings corroded here and there, or otherwise so maimed," (this is a specimen of the pedantic mode of expression of which Mr. Boyle was too fond,) "that without he himself fill up the *lacunæ** out of his memory or invention, they will not be intelligible." He then goes on, to allege his age, and his ill health, as reasons for immediately setting about the arrangement of his papers, and to state that his physician and his best friends have "pressingly advised him against speaking daily with so many persons as are wont to visit him;" representing it as that which must "disable him for holding out long." He therefore intimates, that he means, in future, to reserve two days of the week to himself, during which, "unless upon occasions very extraordinary," he must decline seeing either his friends or strangers, "that he may have some time both to recruit his spirits, to range his papers, and fill up the *lacunæ* of them, and to take some care of his affairs in Ireland, which are very much disordered, and have their face often changed by the public disorders there." He at the same time ordered a board to be placed over his door, giving notice when he did and when he did not receive visits.

Nothing can set in a stronger light than this the celebrity and public importance to which he had attained. His reputation, indeed, had spread over Europe; and he was the principal object of attraction, to all scientific strangers who visited the English metropolis. Living, as it was his fortune to do, at what may be called only the dawn of

* [Vacant places in which something is wanting.—Am. Ed.]

modern science, Boyle perhaps made no discovery, which the researches of succeeding investigators, in the same department, have not, long ere now, gone far beyond. But his experiments, and the immense number of facts which he collected and recorded, undoubtedly led the way to many of the most brilliant results by which, since his day, the study of Nature has been crowned. Above all, he deserves to be regarded as one of the principal founders of our modern chemistry. That science, before his time, was little better than a collection of dogmas, addressing themselves rather to the implicit faith of men, than either to their experience or their reason. These venerable articles of belief he showed the necessity of examining, in reference to their agreement with the ascertained facts of nature; and, by bringing them to this test, exposed the falsehood of many of them. His successors have only had to contribute each his share in building up the new system; he had also to overthrow the old one.

Mr. Boyle died, at the age of sixty-four, in 1691. The experimental science of modern times, never had a more devoted follower; and he claims to be recorded, as having not only given us an illustrious example of the ardent pursuit of philosophy, in a man of rank, but as having dedicated to its promotion the whole advantages of which his station and fortune put him in possession, with a zealous liberality, that has scarcely been surpassed or equalled. Other wealthy patrons of literature and science, have satisfied themselves with giving merely their money, and the *éclat** of their favorable regard, to the cause which they professed to take under their protection; but he spent his life in the active service of philosophy, and was not more the encourager and supporter of all good works done in that name, than a fellow-laborer with those who performed them. For the long period, during which he was, in England, the chief patron of science, he was also and equally its chief cultivator and extender. He gave to it, not only his name, his influence, and his fortune, but his whole time, faculties, and exertions.

* [Splendor, pomp, glory, brilliancy, lustre, show.—Am. Ed.]

There is still one distinguished name, connected with the more recent history of physical science in Great Britain, which we must not omit under our present head; —we mean that of the late HENRY CAVENDISH. Mr. Cavendish was the son of Lord Charles Cavendish, brother of the third Duke of Devonshire, and was born in 1731. He was sent, when young, to a school, then of some celebrity, at Hackney, and afterwards went to Cambridge; but it is believed that he derived his taste for science chiefly from his father, who was not only in the habit of amusing himself with philosophical experiments, but was a good mathematician, and is the author of some determinations with regard to the phenomena of the barometer, of considerable value and importance. Lord Charles Cavendish died at the age of eighty, in the year 1783, at which time he was the senior member of the Royal Society. His son had early shown an attachment to scientific pursuits, to which, indeed, he had resolved to dedicate his life, and to sacrifice every other object of ambition, at a time when he had but the prospect of a very moderate patrimony. It was only after he had passed his fortieth year, that he came into the possession of his large fortune, which was unexpectedly left him by an uncle. He was admitted a Fellow of the Royal Society, in 1760, and very soon began to distinguish himself as one of the most active members of that learned body.

We cannot here attempt any detailed analysis of the papers with which he continued to enrich the 'Transactions,' for a period of nearly fifty years; suffice it to say, that they range over various departments of natural philosophy and chemistry, and are marked throughout by an accuracy, elegance, and often an originality of investigation, which make them models of scientific research and reasoning. Indeed, there are but few names, of the last or present age, belonging to the departments which he cultivated, that are entitled to take precedence of that of Mr. Cavendish. Not to mention his important contributions to the theory of electricity, some of his experiments and determinations in pneumatic chemistry, may

be fairly ranked among the most brilliant discoveries of modern times. What is there, for example, more calculated to interest and astonish even the unscientific mind, than his discovery of the composition of water—so long regarded by all as a perfectly simple element, if there was any such in Nature? The manner, too, in which he made this discovery, affords us a beautiful and instructive example of the right method of examining Nature,—of that cautious and scrutinizing observation by which alone truth is to be detected. The experiments which led to it, were made in the year 1781. Before this, the celebrated Swedish chemist, Scheele, had found that on mixing together, and setting on fire, certain proportions of oxygen gas, or that which forms the principal part of the atmosphere, and hydrogen, or, as it was then called, inflammable air, an explosion was produced, in which, as he imagined, the two elements were dissipated. Cavendish, however, in repeating the experiment, took care to provide himself with the means of watching the phenomena with more precision. For this purpose, he ascertained the weight of his two gases, previous to their combination, and set them on fire in a close vessel, which was perfectly dry. The result was, that, after the explosion, a deposit remained in the vessel, which was found, on examination, to be water, and to be exactly equal in weight to the two gases. This experiment has since been repeated on a larger scale, with the same result; and water, on the other hand, has been decomposed into oxygen and hydrogen.

The great caution with which Mr. Cavendish conducted his inquiries, was one of the most distinguishing characteristics of his method of procedure. To whatever subject he gave his attention, he examined it thoroughly. What we have just stated, is well calculated to show the value of such a habit in philosophy; for this great discovery, of itself enough to immortalize his name, would have eluded him as it had done Scheele, if he had not watched the experiment which revealed it, more narrowly than that chemist. But it was not in this case, only, that the result of his investigations richly rewarded the care and

circumspection with which they had been prosecuted. The patience, with which he used to review and weigh all the circumstances of the case to be resolved, has given a perfection to whatever he has done, from which as much benefit has resulted to the interests of science, as to his own fame; for instead of merely vague and imperfect indications, or hypotheses consisting half of truth and half of error, he has in this way bequeathed to philosophy, either completed discoveries, or investigations, in which, so far as they go, at least, there is no fallacy. He never, it has been remarked, advanced any thing in any of his papers which he had afterwards to retract.

Although experimental science was Mr. Cavendish's favorite pursuit, and that, on his success in which, his fame rests, his stores of information upon other subjects, were known to his friends to be various and extensive. Indeed, he spent his life, if any man ever did, in the pursuit of knowledge, making it his only amusement, as well as his only business. The simple and inexpensive habits of life, which he had formed in his earlier years, underwent no change on his coming into possession of his large fortune. He had accustomed himself, from his youth, to the utmost regularity in all his movements; and his practice in this respect, to his last days, nothing was ever sufficient to derange. What might be called his public scene, was the Royal Society, the meetings of which, he attended punctually, as long as his strength permitted. With this exception, he was but little seen abroad; and, perhaps, the seclusion in which he lived, made his name less popularly known in his own country, than it would otherwise have been, notwithstanding his eminent merits. His fame, however, was more than British—it was Europeanean. On the Continent, where he was regarded without reference to his private habits, and only as the author of many admirable scientific disquisitions, and of some great discoveries, his name stood very high. The chief men of science, in France, gave the strongest proof of the estimation in which they held him, when, in 1803, they elected him one of the eight Foreign Associates of the Institute.

One valuable service, which Mr. Cavendish's wealth enabled him to render to the students of science and literature of his time, was, the establishment of an extensive library, which, with great liberality and public spirit, he threw open for the accommodation, both of his friends, and of all other persons, engaged in intellectual pursuits, who were properly recommended to him; allowing them not only to consult the books, but to carry them home. In the use of this privilege, he made no distinction between himself and the others whom he admitted to share it with him. When he wanted a book for his own perusal, the same application for it was made to the librarian, and the same receipt given for it, as if it had been borrowed by any other reader. Towards the close of his life, after the death of the person who had been accustomed to take charge of the collection, he even used to attend, himself, on a certain day of every week, to give out the books to applicants.

This eminent person died in 1810, full of years and honors. Even in his last moments, something of his love of watching and scrutinizing the phenomena of Nature showed itself; he insisted upon being left to die alone, apparently that he might be able to observe the symptoms of approaching dissolution with the more undisturbed attention. Accordingly, when his servant, whom he had sent out of the room, returned sooner than he had desired, he immediately ordered him again to retire; and when the man came back the second time, he found that his master had breathed his last. In his attachment to philosophy, Mr. Cavendish was all his life so independent of other sources of pleasure, that his fortune, rather possessed than enjoyed, and not expended in the maintenance of any of the show and luxury in which a large revenue usually dissipates itself, had accumulated so greatly, that at the time of his death it is said to have amounted to twelve hundred thousand pounds. He may well be described, therefore, to have been, as a French writer, M. Biot, has quaintly expressed it, the richest of all the learned of his time, as well as probably the most learned of all the rich.

NOTE.

[In several of the preceding chapters, we are taught how valuable may be the possession of rank and riches, to the inquirer after truth. Rank, in the sense in which it is understood in older countries, is unknown among us. No one here acknowledges any higher title, than that of an American citizen. Of wealth, we have however a competent portion. Probably no country on earth presents as great facilities as our own, for the acquisition of riches. In all our cities, we have individuals, who would be considered rich any where; and in every part of our country, there are many in the enjoyment of an abundant income. Would it not be worth the while of such of our fellow citizens, to inquire whether they might not devote themselves to the advancement of science? Some of them, might, by their own labors, increase the boundaries of human knowledge. Others, might employ a portion of their wealth most advantageously, by bestowing upon their children all the benefits of a finished education, and then enabling them to devote themselves to scientific pursuits. Others, might employ a portion of their acquisitions in endowing colleges, founding libraries, assisting, in obtaining an education, young persons of preeminent talent, and thus diffusing among their fellow-men the blessings of intellectual culture. In this country, experience abundantly testifies, that we confer no great blessing on our children, by leaving them in the possession of great wealth. It is better that every one should be, in some degree, at least, the architect of his own fortunes. Would it not, then, be wise, as well as benevolent, to take some of that wealth, which would probably be worse than useless to our children, and devote it to promoting the well-being of our race? Who would not rather diffuse over his native town, in all subsequent ages, the benefits of cultivated intellect, than provide for his son the means of spending a life in indolent, useless luxury? We beg our men of property to ponder upon this. AM. ED.]

CHAPTER V.

Other Individuals of Rank distinguished in Literature and Science :—Marquis of Worcester ; Viscount Brouncker ; Earl of Macclesfield ; Lord Stanhope ; Prince Rupert ; Baron Hermelin ; Marshal Vauban ; Buffon ; Baron von Canstein. Self-educated Cultivators of Science :—Parkes ; Davy.

THE preceding notices are abundantly sufficient to prove, both how frequently men of wealth and rank have resisted all other allurements, to devote themselves to intellectual pursuits, and how many important contributions such persons have been enabled to make to literature, science, and the arts. Yet it would be very easy to add to the list we have given, from a very cursory survey of the history of improvements and discoveries. Thus, to confine ourselves to the arts and sciences only, we might mention, among Englishmen, the celebrated Marquis of WORCESTER, author of the 'Hundred Inventions,' among which, we find the first suggestion of the steam-engine ; his contemporary, Viscount BROUNCKER, the first President of the Royal Society, and noted as the perfector of the theory of fractional arithmetic ; the Earl of MACCLESFIELD, to whom we are principally indebted for the reformation of the calendar, and the introduction of the new style in England ; the late Lord STANHOPE, the inventor of the printing press, known by his name, as well as of many other most ingenious and valuable contrivances ; —and various others, all memorable either as inventors, or as the authors of some decided step in the progress of improvement.

Among natives of other countries, too, Prince RUPERT, as already noticed,* has been considered the discoverer of

* See vol. i. p. 22.

the art of mezzotinto engraving. Baron HERMELIN, a nobleman of Sweden, who died in 1820, was the father of the modern and greatly-improved system of working the mines of that country, which he expended many years of exertion and large sums of money in introducing and establishing. The modern art of fortification, is the creation of the French Marshal VAUBAN, a man of rank and wealth, who, although he spent his life as a soldier, found leisure to write numerous works which have been printed, as well as twelve large volumes in manuscript which he left behind him, entitled 'Mes Oisivetés,'—*My Idle Hours.*

The most elaborate and splendid, though not the most correct, work on Natural History, that was ever written, and the one which, with all its errors, has, perhaps, more than any other, contributed to spread a taste for that science, was the production of another French nobleman, the celebrated Count de BUFFON.

A German nobleman, the Baron von CANSTEIN, is noted, for having discovered and practised at Halle, in the beginning of the last century, a new mode of printing, which appears to have been the same with that now called stereotype. This invention is singular, for its vicissitudes of notoriety and oblivion. The Chinese have had a long acquaintance with the art of printing from blocks or plates, instead of movable types, and among them, it is to this day the only method in use. It was probably also the first form which the art of printing assumed in Europe, was then forgotten, for many years, till it was revived, in the middle of the sixteenth century, at Augsburg, where some of the plates, that were used for the purpose, are still preserved; was again introduced at Leyden, about half a century later; was a few years after reinvented by Canstein; was practised at Edinburgh, in 1744, by William Ged, who was quite ignorant of what had been done by his predecessors; and lastly, after his attempts had ceased to be remembered, was taken up, anew, by the late ingenious Dr. Alexander Tilloch, and Fowlis, the Glasgow printer, who, however, did little more than merely take out a patent for what they deemed their discovery. And even now, after it has been prac-

tised on a larger scale than ever, it does not appear to be gaining ground in general estimation, principally from its inapplicability to works which require improvement in successive editions. If such works are largely corrected, the saving in the plates is in a great degree lost. If that saving is principally regarded, and antiquated opinions or positive errors are multiplied through a paltry economy, the invention is a positive encumbrance to learning, and is therefore of little worth. Unquestionably, the proper range of its application is very limited.

It ought to be observed, that the several block or plate printers we have mentioned, did not all pursue the same method. Faust, for instance, on the invention of printing, employed merely wooden blocks, such as are used by the Chinese, on which the characters were cut out, as is done still in wood-engraving; the Augsburg printers appear to have set up their types in the usual manner, and then to have converted them into a solid plate by pouring melted metal upon the back of the congeries; and the present method, as is well known, is, after having set up the types, to take an impression from them in plaster of Paris, or some other composition, and to cast or found the plate in this as a mould. It does not very clearly appear, what was the plan which Canstein followed; but it is known that he printed a great many volumes, and sold them very cheap. A copy of the New Testament, for instance, he used to sell for fourpence; but, as he was very pious, it is not improbable that he distributed the Scriptures at less even than the cost price, which his fortune enabled him to do. It is said, that it was while endeavoring to devise a cheap method of multiplying copies of the Bible, for the use of the poor, that the notion of his invention suggested itself to him.

Most of the individuals we have here mentioned, who, born to rank and affluence, have devoted themselves to scientific pursuits, were enabled to accomplish what they did, in a great measure, from the peculiar advantages of their position, which afforded them both leisure for the prosecution and maturing of their several schemes, and money to expend on the necessary apparatus and experiments. This proves to how much profit the rich man

may turn his fortunate external circumstances, even in the pursuit of knowledge, if he can only rouse himself to enter with earnestness upon that enterprise. But still, the ambition of aspiring minds, left to struggle unassisted by such external aids, has achieved, after all, quite as great things, as all the resources and immunities of what might be deemed the happiest worldly lot, have ever given birth to. We now return, to accompany, for a while, the onward steps of a few more of those courageous adventurers, who have begun and carried on the work of mental cultivation, without heeding any combination of worldly disadvantages, against which they might have to contend. We shall begin with the cases of one or two individuals so situated, who have distinguished themselves in that same field of experimental science, in which we have just seen what Boyle and Cavendish achieved in their very opposite circumstances.

The first name we shall mention is that of one who has no claim, we believe, to any important discovery in the department which he cultivated, but whose literary works, nevertheless, as well as his history, abundantly testify him to have been a most ingenious and meritorious man. We speak of the late Mr. SAMUEL PARKES, the well-known author of the 'Chemical Catechism.' Mr. Parkes, as we learn from a communication with which we have been favored by his surviving daughter, was born in 1761, at Stourbridge, in Worcestershire, where his father was a small grocer. At five years of age, he was sent to a preparatory school, in his native town; and it is remembered, that, during the time of his attendance at this infant seminary, Mr. Kemble's company of itinerant players having visited Stourbridge, and remained there for some months, that gentleman placed at the same school, his daughter, the child who became afterwards the celebrated Mrs. Siddons. When ten years old, Parkes was sent to another school, at Market-Harborough; but, after remaining here only a very short time, he was taken away and apprenticed to a grocer, at Ross, in Herefordshire. This person happened to be a man of some education, and to be possessed of a few books, which he very kind-

ly lent to his apprentice, and endeavored to give him a taste for reading, but could not, it is said, gain much of his attention. It does not appear how long young Parkes continued in this situation; but at last his master failed, and he returned home to his father.

We now hear no more of him, till he had reached his thirty-second year, up to which time, it seems, he remained at home, assisting his father in the shop. It is probable, from the resources he afterwards displayed, that the foundation of many of his acquirements was laid during this interval. Perhaps he had also saved a little money; for he now went to Stoke-upon-Trent, began business on his own account as a soap-boiler, and married. The new line upon which he entered, shows that he had been already directing his attention to practical chemistry. But, after persevering for ten years in this business, he met with so little success, as to be obliged to give it up; and, at the age of forty-two, he came up to London, with no property in the world, except ten pounds, which had been lent him by his father. It was hard enough to be obliged, as it were, to begin the world again at this time of life; but there was no help for it, and he set to work, resolutely. Some friends whom he had made, lent him a little assistance, and he began manufacturing muriatic acid for the use of dyers. It is very evident, that, although he had come to town without much money in his pocket, he had brought with him some useful knowledge,—one fruit, at least, of the labors of his previous life, of which fortune had not been able to despoil him. This he now turned to excellent account. To his muriatic acid, he soon added other chemical preparations, his skill in manufacturing which, was not long in being generally appreciated, and eventually procured him a large trade and a high reputation.

Although Mr. Parkes had probably given considerable attention to some of the practical parts of chemistry before he went to London, it was only after he had established himself in this last-mentioned line of business, that he began to study the subject scientifically. At this time, as we have seen, he was above forty years of age; so

that he may be quoted as another most encouraging example, for those who have been prevented, by any cause, from commencing their studies till late in life. Notwithstanding the time he had lost, Mr. Parkes became eventually a most accomplished chemist, and gave to the world a succession of works, relating to that science, which, ever since their publication, have held the rank of text-books of high authority. The earliest of these, was his 'Chemical Catechism,' which first appeared in 1805, and of which twelve very large impressions have since been sold. It was translated, soon after its publication, into the German, French, Spanish, and Russian languages; and in Spain and Germany it is the standard manual of instruction in the public schools. By the sale of this work alone the author realized £5000. The Catechism was followed by another work, 'The Rudiments of Chemistry;' and that by the 'Chemical Essays,' in five volumes. This last, in particular, of which a new edition has lately appeared, is an excellent performance, and strikingly shows the author's extensive acquaintance with his subject. Like their precursor, these two works were also translated into the principal continental languages, and obtained great popularity abroad, as well as in this country. Among other gratifying testimonies, which the author received of the sense entertained of his labors, was a splendid ring, presented to him, for his services to science, by the Emperor of Russia.

One of the chief merits of the elementary works, published by Mr. Parkes, and what must doubtless more than any thing else have helped to make them popular, lies in this; that in all his explanations the author begins at the beginning, and no where assumes any information, necessary for understanding the subject, to exist in the mind of the reader beyond what he has himself communicated. It might seem, at first sight, as if this were a part of the art of teaching of no very difficult attainment. Yet, the fact is, that it is a secret of which very few writers have made themselves masters. In general, the person who resorts to a professedly elementary treatise, in order to study any branch of science of which he previously knows

nothing, finds himself stopped, before he has gone very far, by the author paying him the very inconvenient compliment, of addressing him as if he were familiar with many things of which he is quite ignorant. Hence, more than on any other account, the uselessness, or at least the insufficiency, of the greater number of such works, for the end which they are intended to serve. They almost always suppose the reader to know, before he opens them, no inconsiderable part of the very mystery which they profess to teach. It sometimes, no doubt, happens, that the reader does accidentally possess this requisite preliminary information; and then (though no thanks to the author) he will make his way through the book, without being inconvenienced by its deficiencies. In other cases, he may have sufficient ingenuity to deduce from what is stated, some conjecture, more or less vague, as to what is passed over, and in this way, may be enabled to proceed in his perusal, without finding himself absolutely in the dark. But his progress, so conducted, is not only slow, unsatisfactory, and painful, compared to what it might be, but is likely, besides, to leave him at last only half-informed, or misinformed, as to many things which he supposes himself to know.

Perhaps, the best way of employing books, of the description to which we allude, when no better are to be had, is for the student to provide himself with two or more at the same time, upon the subject of which he wishes to make himself master; so that, when he finds one deficient or unintelligible, he may have a chance of finding an interpreter in another. This is a method, which has sometimes been successfully followed, by persons who have been obliged to be their own instructers, after every attempt to understand the science, or other branch of education, which it was desired to learn, by the assistance of a single author, had proved a failure; and we recommend it to others, similarly situated. The probability is, that of two writers, each of whom, at times, expresses himself obscurely, the one will not always or usually fall into that fault, in regard to exactly the same matters as the other; and, therefore, though either alone might be

an inadequate instructer, the two, together, may shed sufficient light on the subject. Besides, of two or more ways of presenting or illustrating the same truth, one mind is most readily reached by one, and another by another; so that, even when no absolute insufficiency can fairly be complained of, in either treatise, the two are still better than one. The force of this last consideration, has induced some popular writers of elementary works, to state the more difficult parts of their subject in a variety of ways, for the sake of more surely impressing them upon the various minds, or moods of mind, they may chance to address; and the practice, when followed judiciously, and so as not to overload the book with unnecessary repetitions, a course which only fatigues the reader, and distracts his attention, is one which may be made greatly to contribute to the clear and effective exposition of the author's meaning.

It may seem strange, that so many writers should have failed, in the observance of a rule of elementary explanation, apparently so simple and easy as that in question. What less difficult, it may be said, or even more natural, than, in expounding any subject, to a mind, which is supposed to be ignorant of its first principles, to state every thing with a recollection of, and in accommodation to, that ignorance? It is only, in the first place, to draw forth the introductory statements from sufficiently familiar instances, and then, in pursuing the line of deduction or demonstration, to advance from one thing to another by sufficiently short steps. But even to do this, requires no common degree of attention, patience, and skill. It is true, that all science, even the highest and most recondite, is deducible from the facts or feelings of ordinary life; but it often happens, that a proficient in a particular science has never viewed it in this connexion. The manner in which he was himself taught it, did not lead him to do so. He was probably carried through what were called its principles, by an exercise of his faith, rather than of his reason; and left to gather a full understanding of them, not so much from what he knew of their foundations, before, as from what he was to see of their

application, afterwards. He was like a man entering a half-darkened apartment, to whom every thing is at first invisible, and who is indebted for the measure of discernment which at last enables him in some sort to distinguish objects, not to any additional light which is thrown upon them from without, but to the expansion of eye which the dimness itself occasions. It may happen, that, in the progress of his studies, his partial acquaintance with one part of the subject, has so much aided his partial acquaintance with another part, that he has, at last, attained to a tolerably clear notion of the whole. But still it remains in his head an insulated system of propositions, altogether withdrawn and separated from those truths of ordinary experience, out of which, nevertheless, it has wholly sprung.

When a person, therefore, who has acquired his knowledge in this manner, sits down to write an elementary book, he will be very apt to overlook that connexion between scientific and common truths, to which his own attention has never been called. He will begin his treatise, not by a reference to something which is understood by every body, but by an announcement, so far ahead of every thing of this kind, that its meaning is likely to be nearly imperceptible, to all except those who have already some acquaintance with the still more remote matters to which it is intended to lead. And his subsequent deductions, will all be apt to be characterized by the same absence of the simple and the natural, proceeding as they do from a mind which did not acquire its own knowledge of the subject from contemplating it in its simplest and most natural aspect.

Now, a self-educated man, when he attempts to explain to others what he has himself learned, is much less likely to fall into this error of manner. His own earliest acquaintance with science was probably made by the aid of that unscientific knowledge which common observation teaches every man; and, having no master to supply the deficiencies of his books, he must have felt painfully the inconvenience of their omissions and obscurities. Hence, in his own performances, springs a method and style of

address in all respects better suited to readers circumstanced as he himself was. He knows, from his own experience, what the difficulties of such readers are, and is therefore both the more solicitous and the better qualified to provide against them. In making his first approach to the science, he does it, through the avenue of certain common and simple facts, calculated to carry with them the apprehension and assent of all; his references are frequent, throughout the work, to considerations of this class, which are always a valuable excitement and help to the mind; and his progress, from one statement to another, is marked by a happy skill, in so selecting and arranging the intermediate points of notice, or, as we may express it, choosing his steps, as to arrive at the ultimate object, at once, by the easiest and the shortest road. For it is of importance to remark, that the secret of this art of perspicuous explanation does not lie so much in an exuberant minuteness of detail, which leaves no particular, whatever, unstated, as in bringing out from the group, and fixing the chief attention on, those comparatively few particulars, which, being themselves apprehended, suggest and supply the rest. A prolix and undiscriminating enumeration of all the items of the case is rather adverse to a clear and effective exposition, tending, as it does, both to weary and confuse the mind. To make the description what it should be, nothing needful should be omitted, and there should be nothing superfluous.

The elementary treatises of Mr. Parkes possess, as we have said, a good deal of this sort of merit, and owe to that circumstance, much of their popularity and usefulness. Those of Ferguson, another self-educated individual, display the same excellence, in a still greater degree, and have always, accordingly, been favorites of those students of science, who, like the writer, have been their own instructers. We may here observe, however, that the advantages of the question and answer method, pursued in the 'Chemical Catechism,' may reasonably be doubted. Where the composition assumes the form of a dialogue or conversation, in which two or more speakers are made, as it were, to examine or discuss the subject,

one proposing his doubts or difficulties, which another meets and solves by the proper reasons and explanations, as is well exemplified, for instance, in some of Mrs. Marcet's treatises, the meaning and convenience of so breaking down the statements, are sufficiently obvious. The attention of young readers, especially, is, perhaps, better kept alive by such an intermixture of the dramatic; and the artifice is also an ingenious one for enabling the author to notice and correct, in the most natural manner, the various misapprehensions into which the mind is apt to fall, on first attempting to make acquaintance with a new subject. But neither of these purposes seems to be, in any degree, answered by merely introducing every sentence, or short paragraph, throughout the work, with a formal interrogatory. Even in a mere school-book, the pupil's ingenuity is best exercised, and his understanding of what he reads most effectually insured, by the questions being left to the teacher, and the answers, themselves, to be given in his own words. The other plan would seem to be calculated only to assist the pupil in learning his task by rote.

Mr. Parkes, in his latter and more prosperous days, used often to dwell, with pleasure, on his struggles in early life, and naturally felt proud of relating the hardships he had surmounted, by his own industry. The success of the different works he published, gave him, as might be supposed, the highest gratification. In addition to the literary performances, which we have already mentioned, we ought to notice two pamphlets, which he gave to the public, in the years 1817 and 1819, in support of the attempt then making, and which was eventually successful, to obtain a repeal of the salt duties. He was one of the most active of the persons who stirred in this matter, anticipating, as it has been already noticed, what the celebrated inventor of the Logarithms appears to have done, great advantages to agriculture, from the use of salt as a manure. Engaged, as he was, in the management of an extensive chemical manufactory, which required unremitting attention, his hours of literary labor were those which he stole from repose, or from the time which most men

give to relaxation and amusement. Yet, besides the different books, which, in the course of a few years, he published, in his own name, he wrote also numerous papers for the different scientific periodical works of the day. As another evidence, too, of his punctuality and indefatigable industry, it may be mentioned, that he had, from an early age, been in the habit of keeping a regular diary of every action of his life, and never retired to bed, till he had committed to writing the events of the day. This, and all his other industrious habits, he kept up to the last; and, even up to within a few days of his death, although he had long been suffering under a painful disease, his attention to business, and especially to his scientific pursuits, continued unrelaxed. He closed his valuable and active life, on the 23d of December, 1825, in the sixty-fifth year of his age.

Neither the acquisition of knowledge, nor that of wealth, then, need be despaired of, even by those who have not succeeded in accumulating much of either, after a large portion of life has been spent, provided they still resolve to exercise industry and perseverance, during the remainder of it. These virtues seldom fail to obtain their natural recompense at last; although, in some cases, they may have to struggle, for a long time, with circumstances very unfavorable to success. A man is sometimes so unfortunately placed, so jammed in and handbound, by the pressure of an unpropitious lot, that, with his best efforts, it is long before he can extricate himself, and obtain even a fair opportunity of exerting what powers he may possess. This seems to have been the case with Parkes, for the first forty years of his life. In the popular phrase, fortune was set against him; he either had no means of engaging in any likely line of well-doing, or, whatever he attempted, turned out unsuccessful.

But, in such a shifting scene as this world is, it can rarely happen that a man shall, during the whole of his lifetime, have the blast against him. As the poet expresses it, "there is a *tide* in the affairs of men,"—an ebbing and flowing of the unstable element on which they are borne,—and if this be only "taken at the flood," the "full sea"

is gained, on which "the voyage of their life" may be made with ease, and the prospect of a happy issue. It is only those, however, who are constantly on the watch for it, that will be prepared to seize the proper moment, when it comes; in other words, nothing but the cultivation and continued exercise of habits of industry and perseverance, even while they bring but small or no immediate return, will enable a man to profit by the most favorable opportunities, when they at last present themselves. To the habitually indolent and thoughtless, it is the same as if the tide never were at flood at all; for they are sure to miss it, when it is. Parkes spent nearly two-thirds of his life, in contending with difficulties which baffled all his attempts to overcome them; and others may, sometimes, be, for as long a period, equally unfortunate. Let such be taught, by his history, that their sky may yet brighten; and, by his example, how to take advantage of it, when it does. The space of life that remained to him, after his more prosperous career began, was comparatively short: but it was long enough to enable him, while he gave the most assiduous attention to business, not only to acquire much knowledge himself, but also to contribute largely to its diffusion, in his own and other countries; and to secure, by his literary works, a highly respectable place among the scientific writers of the time.

But the annals of modern chemistry supply us with a much more splendid name, among the self-taught cultivators of the science. The discoveries of all his predecessors have been surpassed in brilliancy, by those of Sir Humphrey Davy. Davy was born in 1778, at Penzance, in Cornwall. His father followed the profession of a carver in wood, in that town, where many of his performances are still to be seen, in the houses of the inhabitants. All that we are told of Davy's school education, is, that he was taught the rudiments of classical learning at a seminary in Truro. He was then placed by his father with an apothecary and surgeon, in his native place. But, instead of attending to his profession, he spent his time either in rambling about the country, or in experimenting in his master's garret, sometimes to the no

small danger of the whole establishment; and the doctor and he at last agreed to part. About his fifteenth year, he was placed as pupil with another surgeon, residing in Penzance; but it does not appear that his second master had much more success than his first, in attempting to give him a liking for the medical profession. The future philosopher, however, had already begun to devote himself, of his own accord, to those sciences, in which he afterwards so greatly distinguished himself; and proceeding upon a plan of study which he had laid down for himself, he had, by the time he was eighteen, obtained a thorough knowledge of the rudiments of natural philosophy and chemistry, as well as made some proficiency in botany, anatomy, and geometry. The subject of metaphysics, it is stated, was also embraced in his reading at this period.

But chemistry was the science, to which, of all others, he gave himself with the greatest ardor; and, even in this early stage of his researches, he seems to have looked forward to fame from his labors in this department. The writer of the memoir of Sir Humphrey, to which we are indebted for these particulars,* quotes an exclamation which broke from him one day in afterlife, when contemplating, along with a friend, a picture of one of the mines of his native district, which shows what were the visions of his solitary rambles. "How often, when a boy," said he, "have I wandered about those rocks in search after new minerals, and, when tired, sat down upon those crags, and exercised my fancy in anticipations of future renown!" The peculiar features of this part of the country, doubtless contributed, not a little, to give his genius the direction it took. The mineral riches concealed under the soil, formed alone a world of curious investigation. The rocky coast, presented a geological study of inexhaustible interest. Even the various productions cast ashore by the sea, were continually affording new materials of examination to his inquisitive and reflecting mind. The first original experiment, it is related, in which he engaged, had for its object to ascertain the nature of the air contained in the bladders of sea-weed

* Originally published in the 'Spectator' newspaper.

At this time, he had no other laboratory, than what he contrived to furnish for himself, by the assistance of his master's phials and gallipots, the pots and pans used in the kitchen, and such other utensils as accident threw in his way. These he converted, with great ingenuity, to his own purposes. On one occasion, however, he accounted himself particularly fortunate, in a prize which he made. This was a case of surgical instruments, with which he was presented by the surgeon of a French vessel, that had been wrecked on the coast, to whom he had done some kind offices. Examining his treasure, with eagerness, Davy soon perceived the valuable aid he might derive, in his philosophical experiments, from some of the articles; and one of the principal of them was, in no long time, converted into a tolerable air-pump. The proper use of the instruments was, of course, as little thought of, by their new possessor, as that of his master's gallipots was wont to be when he had got them up to his garret.

Davy's subsequent success as an experimentalist, it is well remarked by the writer to whom we have referred above, was probably owing, in no small degree, to the necessity he was placed under, in his earliest researches, of exercising his skill and ingenuity in this fashion. "Had he," proceeds his biographer, "in the commencement of his career, been furnished with all those appliances which he enjoyed at a later period, it is more than probable that he might never have acquired that wonderful tact of manipulation, that ability of suggesting expedients, and of contriving apparatus, so as to meet and surmount the difficulties which must constantly arise, during the progress of the philosopher through the unbeaten tracks and unexplored regions of science. In this art, Davy certainly stands unrivalled; and, like his prototype, Scheele, he was unquestionably indebted for his address, to the circumstances which have been alluded to: there never, perhaps, was a more striking exemplification of the adage, that "necessity is the parent of invention."

A curious catalogue might be made, of the shifts to which ingenious students, in different departments of art,

nave resorted, when, like Davy, they have wanted the proper instruments for carrying on their inquiries or experiments. His is not the first case in which the stores of an apothecary's shop are recorded to have fed the enthusiasm, and materially assisted the labors, of the young cultivator of natural science. The German chemist, SCHEELE, who has just been mentioned, and whose name ranks in his own department with the greatest of his time, was, as well as Davy, apprenticed in early life to an apothecary. While living in his master's house, he used secretly to prosecute the study of his favorite science, by employing often half the night in reading the works that treated of it, or making experiments with instruments, fabricated, as Davy's were, by himself, and out of equally simple materials. Like the young British philosopher, too, Scheele is recorded to have sometimes alarmed the whole household by his detonations ;—an incident, which always brought down upon him the severe anger of his master, and heavy menaces, intended to deter him from ever again applying himself to such dangerous studies, which, however, he did not long regard.

It was at an apothecary's house, as has been noticed in a former page, that Boyle and his Oxford friends first held their scientific meetings, induced, as we are expressly told, by the opportunity they would thus have, of obtaining drugs wherewith to make their experiments. Newton lodged with an apothecary, while at school, in the town of Grantham; and as, even at that early age, he is known to have been ardently devoted to scientific contrivances and experiments, and to have been in the habit of converting all sorts of articles into auxiliaries in his favorite pursuits, it is not probable that the various strange preparations which filled the shelves and boxes of his landlord's shop would escape his curious examination. Although Newton's glory chiefly depends upon his discoveries in abstract and mechanical science, some of his speculations, and especially some of his writings on the subjects of light and color, show that the internal constitution of matter, and its chemical properties, had also much occupied his thoughts. Thus, too, in other

departments, genius has found its sufficient materials and instruments in the humblest and most common articles, and the simplest contrivances. Ferguson observed the places of the stars by means of a thread with a few beads strung on it, and Tycho Brahe did the same thing with a pair of compasses. The self-taught American philosopher, Rittenhouse, being, when a young man, employed as an agricultural laborer, used to draw geometrical diagrams on his plough, and study them as he turned up the furrow. Pascal, when a mere boy, made himself master of many of the elementary propositions of geometry, without the assistance of any master, by tracing the figures on the floor of his room with a bit of coal. This, or a stick burned at the end, has often been the young painter's first pencil, while the smoothest and whitest wall he could find, supplied the place of a canvass. Such, for example, were the commencing essays of the early Tuscan artist, Andrea del Castagno, who employed his leisure, in this manner, when he was a little boy tending cattle, till his performances at last attracted the notice of one of the Medici family, who placed him under a proper master. The famous Salvator Rosa first displayed his genius for design in the same manner. To these instances, may be added that of the late English musical composer, Mr. John Davy, who is said, when only six years old, to have begun the study and practice of his art, by imitating the chimes of a neighboring church with eight horse-shoes, which he suspended by strings from the ceiling of a room in such a manner as to form an octave.*

But to return to the subject of our notice. Davy first pursued his chemical studies, without teacher or guide, in the manner that has been described, and aided only

* There is an excellent little work by a German writer, Campe, entitled *The New Robinson*, which, in an account of the various expedients supposed to be resorted to by a young seaman, cast ashore on an uninhabited island, and obliged to provide for himself sustenance and shelter, by the aid merely of such implements as he could fashion by his own ingenuity, presents a very interesting picture of the manner in which many of the ordinary processes of mechanical art might be performed without the ordinary tools. The work has been translated into English.

by the scantiest and rudest apparatus. When still a lad, however, he was fortunate in making the acquaintance of Mr. Gregory Watt, the son of the celebrated James Watt. This gentleman, having come to reside at Penzance for the recovery of his health, lodged with Mrs. Davy, and soon discovered the talent of her son. The scientific knowledge of Mr. Watt gave an accurate direction to the studies of the young chemist, and excited him to a systematic perseverance in his favorite pursuit. Chance attracted to him the notice of Mr. Davies Giddy, (afterwards Mr. Gilbert, President of the Royal Society,) which the discovery of his merits soon improved into patronage and friendship. The boy, we are told, was leaning on the gate of his father's house, when Mr. Gilbert passed, accompanied by some friends, one of whom remarked, that there was young Davy, who was so much attached to chemistry. The mention of chemistry immediately fixed Mr. Gilbert's attention; he entered into conversation with the young man, and, speedily becoming convinced of his extraordinary talents and acquirements, offered him the use of his library, and whatever other assistance he might require, for the pursuit of his studies. Mr. Gilbert and Mr. Watt, soon after this, introduced Davy to the celebrated Dr. Beddoes, who had just established at Bristol what he called his Pneumatic Institution, for investigating the medical properties of the different gases. Davy, who was now in his nineteenth year, had for some time been thinking of proceeding to Edinburgh, in order to pursue a regular course of medical education; but Dr. Beddoes, who had been greatly struck by different proofs he had given of his talents, and especially by an essay in which he propounded an original theory of light and heat, having offered him the superintendence of his new institution, he at once closed with that proposal.

The young philosopher was now fairly entered on his proper path, and, from this period, we may consider him as having escaped from the disadvantages of his early lot.

But it was while yet poor, and unknown, that he had made those acquirements, which both obtained for him

the notice of his present patrons, and fitted him for the situation in which they placed him. His having attracted the attention of Mr. Gilbert, as he stood at his father's gate, may be called a fortunate incident; but was one that never would have happened, had it not been for the proficiency he had already made in science, by his own endeavors. Chance may be said to have offered this opportunity of emerging from obscurity; but, had he not previously labored in the cultivation of his mind, as he had done, it would to him have been no opportunity at all.

The experiments conducted by Davy, and under his direction, at the Bristol Institution, were soon rewarded by important results; and of these, Davy, when he had just completed his twenty-first year, published an account, under the title of 'Researches, Chemical and Philosophical, chiefly concerning Nitrous Oxide, and its respiration.' In this publication, the singularly intoxicating effects produced by the breathing of nitrous oxide were first announced, and it excited a considerable sensation in the scientific world, and at once made Davy generally known, as a most ingenious and philosophic experimentalist. He was in consequence, soon after its appearance, invited to fill the chemical chair of the Royal Institution, then newly established. When he commenced his lectures here, he was scarcely twenty-two years of age; but never was success in such an attempt more decided and brilliant. He soon saw his lecture-rooms crowded, day after day, by all that was most distinguished in the rank and intellect of the metropolis; and his striking and beautiful elucidations of every subject that came under his review, riveted, often even to breathlessness, the attention of his splendid auditory. The year after his appointment to this situation, he was elected also Professor of Chemistry to the Board of Agriculture; and he greatly distinguished himself by the lectures which, for ten successive sessions, he delivered in this character. They were published, in 1813, at the request of the Board. In 1803, when only in his twenty-fifth year, Davy was elected a Fellow of the Royal Society, and his contributions to the 'Transactions,' from this time till his death,

were frequent, and of the highest value. In 1806, he was chosen to deliver the Bakerian lecture before the Society; and he performed the same task for several successive years. Many of his most brilliant discoveries were announced in these discourses. In 1812, he received the honor of knighthood from the Prince Regent, being the first person on whom his Royal Highness conferred that dignity; and two days after, he married a lady who brought him a considerable fortune. Next year, he was elected a corresponding member of the French Institute. He was created a baronet, in 1818. In 1820, he was chosen a foreign associate of the Royal Academy of Sciences at Paris, on the death of the illustrious Watt. He had been, for some time, secretary to the Royal Society; and, in 1820, on the death of Sir Joseph Banks, he was, by a unanimous vote, raised to the Presidency of that learned body,—an office which he held, till he was obliged to retire, from ill health, in 1827, when his friend and first patron, Mr. Gilbert, was chosen to succeed him. Little, we may suppose, did either of the two anticipate, when they first met, thirty years before, at the gate of Davy's father's house, that they would thus stand successively, and in this order, at the head of the most distinguished scientific association in England.

It is impossible for us in this place to attempt any thing more than the most general sketch of Sir Humphrey Davy's numerous and most important discoveries in chemical science. Even his earliest publication, the title of which we have already transcribed, was regarded as, for the first time, introducing light and order into an interesting department of the science,—the theory of the various combinations of oxygen and nitrogen, the two gases which, mixed together in certain proportions, form our common atmospheric air, but in other proportions produce compounds of an altogether dissimilar character. The first memoir, by Davy, which was read before the Royal Society, was presented by him in 1801, before he was a member. It announced a new theory, which is now generally received, of the galvanic influence, or the

extraordinary effect produced by two metals in contact with each other, when applied to the muscle even of a dead animal, which the Italian professor, Galvani, had some years before, accidentally discovered. It was supposed, both by Galvani and his countryman Volta, who also distinguished himself in the investigation of this curious subject, that the effect in question was an electrical phenomenon,—whence galvanism used to be called animal electricity; but Davy showed, by many ingenious experiments, that, in order to produce it, the metals in fact underwent certain chemical changes. Indeed, he proved that the effect followed, when only one metal was employed, provided the requisite chemical change was by any means brought about on it, as, for example, by the interposition between two plates of it, of a fluid, calculated to act upon its surface in a certain manner. In his Bakerian lecture, for 1806, he carried the examination of this subject to a much greater length, and astonished the scientific world by the announcement of a multitude of the most extraordinary results, from the application of the galvanic energy to the composition and decomposition of various chemical substances. From these experiments, he arrived at the conclusion, that the power called chemical affinity was, in truth, identical with that of electricity. Hence the creation of a new science, now commonly known by the name of Electro-Chemistry, being that which regards the supposed action of electricity in the production of chemical changes. The discourse, in which these discoveries were unfolded, was crowned by the French Institute with their first prize, by a decision which reflects immortal honor upon that illustrious body; who thus forgot, not only all feelings of national jealousy, but even the peculiar and extraordinary hostility, produced by the war which then raged between the two countries, in their admiration of genius, and their zeal for the interests of philosophy.

But the results which this great chemist had already obtained, only formed, in his hands, the source of new discoveries. In the interesting and extraordinary nature of its announcements, the Bakerian lecture of 1807, was

as splendid a production as that of the former year. There are certain substances, as the reader is aware, known in chemistry by the name of alkalis, of which potash and soda are the principal. These substances, chemists had hitherto in vain exhausted their ingenuity, and the resources of their art, in endeavoring to decompose. The only substance possessing alkaline properties, the composition of which had been ascertained, was ammonia, which is a gas, and is therefore called *volatile* alkali; and this having been found to be a compound of certain proportions of hydrogen and nitrogen, an opinion generally prevailed, that hydrogen would be found to be also a chief ingredient of the *fixed* alkalis. Davy determined, if possible, to ascertain this point, and engaged in the investigation with great hopes of success, from the surpassing powers of decomposition which he had found to belong to his new agent, the galvanic influence. The manner in which he pursued this object, is one of the most beautiful specimens of scientific investigation on record.

One of the most important of the laws of galvanic decomposition, which he had previously discovered, was, that, when any substance was subjected to this species of action, its oxygen (an ingredient which nearly all substances contain) was developed at what is called the positive end or pole of the current of electricity, while, whenever any hydrogen or inflammable matter was present, it uniformly appeared at the opposite or negative pole.

Proceeding upon this principle, therefore, Davy set to work with a fixed alkali; and at first, submitted it, dissolved in water, to the galvanic action. The result, however, was, that the water alone was decomposed, nothing being disengaged, by the experiment, but oxygen and hydrogen, the ingredients of that fluid, which passed off as usual, the former at the positive, the latter at the negative pole. In his subsequent experiments, therefore, Davy proceeded without water, employing potash in a state of fusion; and, having guarded the process from every other disturbing cause that presented itself, by a variety of ingenious arrangements, he had at last the satisfaction of seeing the oxygen gas developed, as before, at the positively

electrified surface of the alkali, while at the same time, on the other side, small globules of matter were disengaged, having all the appearances of a metal. The long-agitated question was now determined; the base of the fixed alkalis was clearly metallic.

To ascertain the qualities of the metallic residue, which he had thus obtained from the potash, was Davy's next object. From its great attraction for oxygen, it almost immediately, when exposed to the atmosphere, became an alkali again, by uniting with that ingredient; and at first, it seemed, on this account, hardly possible to obtain a sufficient quantity of it for examination. But at last Davy thought of pouring over it a thin coating of the mineral fluid called naphtha, which both preserved it from communication with the air, and, being transparent, allowed it to be examined.

We have thus rapidly sketched the course of these brilliant and successful experiments, because they form a most interesting and instructive exemplification of the manner in which knowledge is pursued, and the secrets of Nature extorted from her, by well-directed interrogation. The business of philosophic experiment, it may be well to observe, is not a mere random expenditure of tests and applications. The true disciple of the inductive philosophy, on the contrary, has always in his contemplation, while conducting his experiments, an idea or end which he aims at realizing, and which, in fact, directs him to every experiment to which he resorts. Thus, in the present instance, the idea in Davy's mind was, that the alkali was compounded of two ingredients which had severally an attraction for the two opposite poles of the electric current. This idea he never lost sight of, throughout the whole course of his experiments, though he repeatedly shifted his ground, in regard to the contrivances, by which he sought its proof and manifestation. To proceed in any other way, would not be to philosophize, but merely, as it were, to dip the hand into the bag of chance, in quest of a discovery, as men draw prizes at a lottery.

It is true, that, until the experiment has confirmed or

refuted his expectations, this guiding idea, upon which the experimenter proceeds, must be regarded merely as a conjecture. But such a conjecture or hypothesis, he must have in his mind, or he is in no condition to set about the inquisition of Nature. What progress would the conductor of a trial, in a court of justice, be likely to make, in questioning a witness, without some previous notion of the truth, which the evidence was likely to establish? He might waste the whole day in putting questions and receiving answers, and at last have ascertained nothing. Just as unprofitably would the interrogator of Nature spend his time, if he had no directing anticipation in every case, according to which to order his experiments. Accident might, it is possible, throw a discovery in his way; but his own occupation would be evidently as idle, and as little that of a philosopher, as the rattling of a dice-box. *Whenever, indeed, a discovery is made, without being anticipated, we say that it has been made by chance.* On the other hand, the history of all discoveries, that have been arrived at by what can, with any propriety, be called philosophical investigation and induction, attests that necessity which has been asserted, of the experimenter proceeding in the institution and management of his experiments upon a previous idea of the truth to be evolved. This previous idea, is what is properly called an *hypothesis*, which means something *placed under* as a foundation or platform, on which to institute and carry on the process of investigation. A *theory* is a completed view of an harmonious system of truths, evolved and proved by calculation or induction. As the latter is the necessary completion of every philosophical inquiry, so the former is its equally indispensable beginning. It is the aim in the mind of the philosopher, without which he cannot philosophize. It makes, in short, the main difference between the experiments of the philosopher in his laboratory, and those of the child among his playthings. Of course, however, every hypothesis must give way, before an experiment, the result of which cannot be reconciled with it. Newton,* in proceeding

* See vol. i. p. 14.

to investigate the system of the heavens, set out on the hypothesis that the same power of gravitation, which made a stone fall to the ground, would be found to retain the moon and the planets in their orbits, around the earth and the sun. The result of his first calculation was unfavorable to this supposition, and he at once abandoned it. We have, here, an example, both of the use of an hypothesis, and of the proper limits of reliance on it. The grand discovery, which eventually resulted from Newton's investigations, affords us, again, an illustration of the manner in which an hypothesis serves to lead to, and originate a theory.*

The metal which Sir Humphrey Davy obtained from potash, he called *Potassium*; and from soda, he also, by a similar process, obtained another, which he called *Sodium*. Both these new metals, he found to possess several curious properties, which, however, we cannot here stop to enumerate. He afterwards decomposed also the different earths, and showed them to be all, as well as the alkalis, compounds of oxygen with a metallic base. But these important discoveries, which may be said to have revolutionized the science of chemistry, were not the only results which he obtained from his galvanic and electrical experiments. The interesting subject of the connexion between electricity and magnetism, received considerable elucidation from his researches. For an account of his contributions to this branch of science, we must refer to the able memoir we have already mentioned, or to his papers on the magnetic phenomena produced by electricity, in the 'Philosophical Transactions.'†

Meanwhile, his attention had been attracted to another subject of the greatest practical importance—the possibility of preventing the destructive explosions in coal-mines occasioned by the fire-damp, or inflammable gas, which is found in many parts of them. By a series of experiments, Davy found that this dangerous gas, which

* See this subject admirably treated in the Preliminary Discourse to the Encyclopedia Metropolitana.

† Philosophical Transactions, for 1819.

was known to be nothing more than the hydrogen of the chemists, had its explosive tendencies very much restrained, by being mixed with a small quantity of carbonic acid and nitrogen, (the ingredient which, along with oxygen, forms atmospheric air;) and that, moreover, if it did explode, when so mixed, the explosion would not pass through apertures less than one-seventh of an inch in diameter. Proceeding, therefore, upon these ascertained facts, he contrived his celebrated *Safety Lamp*. It consists of a small light, fixed in a cylindrical vessel, which is every where air-tight, except in the bottom, which is formed of fine wire gauze; and in the upper part, where there is a chimney for carrying off the foul air The air admitted through the gauze suffices to keep up the flame; which, in its combustion, produces enough of carbonic acid and nitrogen to prevent the fire-damp, when inflamed within the cylinder, from communicating the explosion to what is without. The heretofore destructive element, thus caught and detained, is therefore not only rendered harmless, but actually itself helps to furnish the miner with light, the whole of the interior of the cylinder being filled with a steady green flame, arising from the combustion of the hydrogen, which has been admitted to contact with the heat, but cannot carry back the inflammation it has received, to the general volume without. Armed with this admirable protection, therefore, the miner advances without risk, and with sufficient light to enable him to work, into recesses which formerly he could not have dared to enter. The safety lamp has already been the means of saving many lives, and has enabled extensive mines, or portions of mines, to be wrought, which but for its assistance must have remained unproductive. The coal-owners of the northern districts, invited Sir Humphrey, in 1817, to a public dinner, and presented him with a service of plate, of the value of £2000, [$8,888,] in testimony of what they felt to be the merit of this invention.

We will mention only another of this eminent individual's ingenious practical applications of those scientific truths with which he enriched the philosophy of his age.

About the year 1823, the attention of the Commissioners of the British Navy was so strongly excited, to the fact of the rapid decay of the copper sheathings of ships, when exposed to the action of the salt water, that they applied to the Royal Society, to take the subject into consideration, and endeavor to devise a remedy for the evil. On this occasion, Davy again had recourse to those principles of electro-chemistry, of which he had himself been the discoverer, and by the application of which, he had already obtained so many brilliant results. One of the laws of electrical agency, which he considered himself to have ascertained, was, that two substances can only combine, by what is called chemical affinity or attraction, when they are in opposite electrical states,—that is to say, when the one is positively, and the other negatively, electrified. The copper and the water, therefore, he concluded, were naturally in these circumstances; and all that would be required, consequently, to prevent the action of the one upon the other, would be, to change the electrical condition of that one of them, namely, the copper, which it was possible to submit to the necessary treatment. He thought of various ways of effecting this object; but, at last, he determined to try the effect of merely placing a quantity of zinc or iron in contact with the copper; the former metals being more positive than the latter, and therefore fitted, by induction, to repel a portion of its electricity, and so to render it negative like the water. The result surpassed his expectations. So powerfully did the one metal act, in reversing the electrical state of the other, that a bit of zinc or iron, no larger than a pea, was found sufficient to protect from corrosion, forty or fifty square inches of copper. Nothing, therefore, could be more perfect, than the success of this contrivance, for the particular purpose it was intended to serve. But, unfortunately, it has been found, by experience, that, although Davy's method completely answers for preventing the wasting of the copper, the sea-weeds and marine insects accumulate, in such quantities, upon the bottoms of ships so protected, that they become, after a short time, scarcely navigable. For the present, therefore, the

use of the zinc and iron is of necessity abandoned. It is by no means improbable, however, that some expedient may be contrived, for counteracting this consequence of the application of Davy's invention; in which case, it will be entitled to rank as one of the most valuable discoveries, ever made.

We have thus, guided chiefly by the 'Memoir,' of which mention has been made above, pursued the principal triumphs of Sir Humphrey's splendid career, and described what he achieved, although cursorily and briefly, in such a manner, we trust, as to put even the unscientific reader in possession of a tolerably just view of the great discoveries on which his fame rests. In 1827, as we have already mentioned, his health had become so bad, that he found it necessary to resign the presidency of the Royal Society. Immediately after this, he proceeded to the Continent. During his absence from England, he still continued to prosecute his chemical researches, the results of which he communicated, in several papers, to the Royal Society. He also, notwithstanding his increasing weakness and sufferings, employed his leisure in literary composition, on other subjects, an evidence of which appeared in his 'Salmonia,' a treatise on fly-fishing, which he published in 1828. This little book is full of just and pleasing descriptions of some of the phenomena of Nature, and is imbued with an amiable and contented spirit. His active mind, indeed, continued, it would seem, to exert itself, to the last, almost with as unwearied ardor as ever. Besides the volume we have just mentioned, another work, entitled 'The Last Days of a Philosopher,' which he also wrote during this period, has been given to the world, since his death. He died at Geneva, on the 30th of May, 1829. He had only arrived in that city the day before; and having been attacked by apoplexy, after he had gone to bed, expired at an early hour in the morning.

No better evidence can be desired, than that we have in the history of Davy, that a long life is not necessary to enable an individual to make extraordinary advances in any intellectual pursuit, to which he will devote himself with

all his heart and strength. This eminent person was, indeed, early in the arena, where he won his distinction; and the fact, as we have already remarked, is a proof, how diligently he must have exercised his mental faculties, during the few years that elapsed between his boyhood and his first appearance before the public, although, during this time, he had scarcely any one to guide his studies, or even to cheer him onward. Yet, notwithstanding that he had taken his place, as we have seen, among the known chemists of the age, almost before he was twenty-one, the whole of his brilliant career in that character, embracing so many experiments, so many literary productions, and so many splendid and valuable discoveries, extended only over a space of not quite thirty years. He had not completed his fifty-first year, when he died. Nor was Davy merely a man of science. His general acquirements were diversified and extensive. He was familiar with the principal continental languages, and wrote his own with an eloquence not usually found in scientific works. All his writings, indeed, show the scholar, and the lover of elegant literature, as well as the ingenious and accomplished philosopher. It not unfrequently happens, that able men, who have been their own instructers, and have chosen for themselves some one field of exertion, in which the world acknowledges, and they themselves feel, their eminence, both disregard and despise all other sorts of knowledge and acquirement. This is pedantry, in its most vulgar and offensive form; for it is not merely ignorant, but intolerant. It speaks highly in favor of the right constitution and the native power of Davy's understanding, that, educated as he was, he escaped every taint of this species of illiberality; and that, while, like almost all those who have greatly distinguished themselves in the world of intellect, he selected and persevered in his one favorite path, he nevertheless revered wisdom and genius, in all their manifestations.

CHAPTER VI.

Diversities of Intellectual Excellence :—English Painters :—Spencer ; Highmore ; Hannam ; Wright ; Gilpin ; Gainsborough ; Barry ; Lawrence.

THE ambition of intellectual excellence is, in truth, the same passion, by whichsoever of the many roads that lie open to it, it may choose to pursue its object. The thing that is interesting and valuable is the purity and enduring strength of the passion. These are the qualities that make it both so inestimable in the possession, and so instructive in the exhibition. The mere department of study in which it displays itself, is of inferior importance ; for, even if it should be contended that, of the various pursuits which demand the highest degree of intellectual application and devotion, one is yet better calculated than another to promote, by its results, the general improvement or happiness of mankind, it will scarcely be argued, that even those of inferior value, in this respect, should not also have their followers. The arrangements of Providence, by forming men at first in different moulds, and placing them afterwards in different circumstances, regulate, doubtless with more wisdom and success than could be attained by any artifice of human polity, the distribution of taste, and talent, and enterprise, over the varied field of philosophy and art, no part of which is thus left altogether uncultivated. One man, from his original endowments, or his particular advantages of training or situation, is more fit for one line of exertion, another for another ; and, although the pursuits to which they are in this manner severally attracted, may not, in the largest view, be of equal importance, that is no reason why we should regret that there are laborers to engage in each. Indeed, the more truly enlightened any mind is,

the less ready will it be to look with a feeling either of contempt or of slight respect upon any pursuit which has had power to call forth in an eminent degree the resources of the human intellect. The ground is holy, wherever genius has won its triumphs. The further the domain of science is explored, the more, in all probability, will it be found to be pervaded and connected, in all its parts, by a principle of order, consistency, and unity; and the more confirmations shall we discover of what are almost already universally admitted axioms of philosophy, that no truth is without its worth, and no sort of knowledge without some bearing upon every other.

We are now about to notice the exertions made in pursuit of knowledge by some individuals, whose paths have been very different from those of the distinguished discoverers and inventors with whom we have just been engaged. But we shall find that, in every variety of intellectual enterprise, the same devotion and diligence have been exhibited by ardent and generous spirits; and that every where these qualities are the indispensable requisites for the attainment of excellence. By no class of students, perhaps, has a greater love of their chosen pursuit been displayed, than by Painters. We have already had occasion, indeed, to mention many names from this department of biography, in illustration of the force with which a passion for knowledge has often contended against the most depressing discouragements, and eventually subdued every thing that would have prevented its gratification. In our former volume, we noticed the early difficulties, and subsequent eminence, of Salvator Rosa, Claude Lorraine, the Caravaggios, Opie, and many others. We will now proceed to sketch, somewhat more in detail, the unpromising circumstances of birth and original situation through which some of the other most distinguished names in the recent history of the art of Painting, have had to struggle into light.

Jarvis Spencer, who was celebrated as a miniature painter, in the latter part of the last century, was originally a menial servant, and, while in that condition, used to amuse himself by attempting to draw, when no one

suspected what he was about. At last, one of the family, in whose service he lived, having sat to an artist for a miniature, the performance, when it was finished, was seen by Spencer, who immediately remarked, very much to the surprise of every body, that he thought he could make a copy of it. He was allowed to try his skill, and succeeded to admiration. His master, upon this discovery of his servant's genius, very generously exerted himself to place him in his proper sphere, and to make him generally known; and Spencer, as we have said, rose eventually to great eminence in the department which he cultivated.

Joseph Highmore, who painted, among other well-known works, the Hagar and Ishmael, in the Foundling Hospital, and long enjoyed high reputation, both for his historical pictures and his portraits, taught himself the art which he afterwards practised with so much success, while he was serving his apprenticeship in a solicitor's office, and was without any one to give him a lesson. Highmore died in 1780.

Another painter of that day, of the name of Hannam, whose works, however, have not attracted much attention, was originally an apprentice to a cabinet-maker; and having acquired some skill in painting, by his own efforts, used to be allowed by his master to spend as much of his time as he chose, in executing pictures for those who gave him commissions, on condition of his handing over the price to his master, who found that he made more, in this way, than he could have done, by keeping Hannam to his regular work.

Richard Wright, who, about the same period, was much celebrated for his sea-pieces, rose from the condition of a house and ship-painter, having taught himself to draw while he followed that trade, in his native town of Liverpool.

The late Royal Academician, Sawrey Gilpin, so celebrated, especially, for his most faithful and spirited delineations of animals, was also originally apprenticed to a ship-painter. He lodged in Covent Garden, and there being a view of the market from the window of his apart-

ment, Gilpin used to amuse himself in making sketches of the horses and carts, with their attendants, as they passed, or formed themselves into picturesque groups in the square.

GAINSBOROUGH, the great landscape painter, again, led by his different genius, used, while yet a mere boy, to resort to the woods and pasture fields in the neighborhood of his native town of Sudbury, and there to employ himself unweariedly, often from morning till night, in sketching, with his untutored pencil, the various objects that struck his fancy, from a flock of sheep, or the shepherd's hut, to the stump of an old tree. It was to these studies of his earliest years, undoubtedly, that Gainsborough was indebted both for that perfect truth and fidelity by which his works are distinguished, and for that deep feeling of the beautiful in Nature which has thrown over them so inexpressible a charm. He learned, also, in this way, a habit of diligent, minute, and accurate observation, which never left him; and it is both interesting and instructive, to read the account which has been given, of the unrelaxed zeal with which he continued to pursue the study of his art, even to the last. "He was continually remarking," says Sir Joshua Reynolds, speaking of the habits of his more mature years, "to those who happened to be about him, whatever peculiarity of countenance, whatever accidental combination of figures, or happy effects of light and shadow occurred in prospects, in the sky, in walking the streets, or in company. If, in his walks, he found a character that he liked, and whose attendance was to be obtained, he ordered him to his house; and from the fields he brought into his painting-room, stumps of trees, weeds, and animals, of various kinds; and designed them, not from memory, but immediately from the objects. He even framed a kind of model of landscapes on his table, composed of broken stones, dried herbs, and pieces of looking-glass, which he magnified and improved into rocks, trees, and water; all which exhibit the solicitude and extreme anxiety which he had about every thing relative to his art; that he wished to have his objects embodied, as it were, and distinctly before him,

neglecting nothing that contributed to keep his faculties alive, and deriving hints from every sort of combination." It is not, indeed, generally, the highest genius, which is least inclined to avail itself of such assistance in its labors, as study and pains-taking may procure.

Another of the most distinguished names, in the list of recent British artists, is that of JAMES BARRY. Barry was born at Cork, in 1741. His father appears to have been a somewhat unsettled character, or at least to have shifted from one pursuit to another, probably without obtaining much success in any. It is commonly said that he was originally a mason; but some authorities state, that he had been also a victualler. At the time of Barry's birth, he was the master of a small coasting vessel, in which he traded between England and Ireland.

Barry is understood to have received a good education, in the ordinary branches of scholarship. At an early age, however, his father took him with him to sea, and made him do duty as a shipboy. This occupation he detested. The love of painting had already taken possession of him, and his greatest pleasure was to cover the deck with sketches of objects made with chalk or ochre. His father, at last, finding all his efforts, to make him a sailor, of no avail, allowed him to remain at home, and to pursue his studies in literature and art. He now returned to school, and distinguished himself by an ardor and diligence, which left all his class-fellows behind him. Even his play-hours were generally given to hard study. Instead of associating with the other boys, in their amusements, his practice was, to retire to his room, and there to employ himself in reading or painting. Whatever money he got, he spent in purchasing books, or candles to enable him to read during the night. His enthusiasm was at this time, (and indeed throughout his life,) partly sustained also by certain notions of the virtue of ascetic observances, which he had derived from his mother, who was a Roman Catholic, and had great influence over him. In conformity with these opinions, he was wont to sleep, when he did take rest, upon the hardest bed, and to wear the coarsest clothes he could procure. These theological

prejudices were not calculated to have a salutary effect, upon the growth of a character like that of Barry, whose morose and melancholy temperament rather required an education, calculated to bring the gentler affections of his nature more into play.

His ardor in study, however, both at this and every other part of his life, was admirable. He had, as yet, but few books of his own, but he borrowed from all who had any to lend, and sometimes learned the passages, which he liked, by heart, (a practice of which he soon found the advantage, in the growing strength of his memory,) and sometimes transcribed them. It is said, that transcripts of several entire volumes, which he had made at this period, were found, after his death, among his papers. Among the works, which he especially delighted to study, it is recorded, were many on controversial divinity,—unfortunately not the most wholesome sustenance, for an intellectual and moral organization like his.

He was in his seventeenth year, when he first attempted to paint in oil; and for some years, he wrought, with no one to encourage or to notice him. Among the first performances, which he produced, were compositions, on the escape of Æneas from Troy, the story of Susannah and the Elders, and that of Daniel in the Lion's Den. These pictures he hung up on the walls of his father's house, and there they remained, long after the painter's fame had spread over Europe. At last, in his twentieth or twenty-first year, he produced a work which appeared to himself such as he might exhibit in a more public place. This was a picture, on the fine subject of the baptism, by St. Patrick, of one of the kings of Cashel, who stands unmoved while the ceremony is performed, amidst a circle of wondering and horror-struck spectators, although the saint, in setting down his crosier, has, without perceiving it, struck its iron point through the royal foot. With this work, he set out for Dublin, and placed it in the exhibition room of the Society for the Encouragement of Arts. It was universally admired. But no one knew the artist, or fancied that he was a native of the country; and when Barry, who used frequently to come to the room, to ob-

serve the impression it made, dressed in the same coarse attire, which he wore in the country, one day, overcome by emotions which he could no longer conceal, announced himself the painter of the picture, his avowal was received with an incredulous laugh. He burst into tears, and left the room.

The patriotism of his countrymen, however, amply recompensed him for this, when they found that he, an Irishman, was really the person who had produced this admired performance. The young ascetic soon found himself the favorite of the gayest society of his native metropolis. But perceiving that this new course of life interrupted his studies, and seduced him, occasionally, into worse follies, he became alarmed, and determined to withdraw himself from it, before it should have become a habit. These feelings came over him, with so much force, one night, when he was returning from a tavern, where he had spent the evening with a bacchanalian party, that he actually threw what money he had in his pocket, into the river, cursing it as having betrayed him into the excesses of which he had been guilty, and from that day, returned to his books and his easel.

Meantime, however, he had also acquired some worthier friends; and, among others, had been introduced to the illustrious Edmund Burke, then commencing his splendid political career, as assistant to the secretary of the Lord Lieutenant. A story has been told respecting Barry's first interview with Burke, which would be interesting, if it could be received as true. Having got into an argument with each other, Barry is said to have quoted a passage, from the 'Essay on the Sublime and Beautiful,' in support of his opinion; on which Burke expressed himself slightingly of that anonymous performance. This insensibility to the merits of a work which was one of his especial favorites, fired Barry, and, after vehemently eulogizing the book, he concluded by declaring, that not having been able to purchase it, when it first came into his hands, he had actually transcribed the whole of it. His surprise and delight were extreme, when, in reply to this appeal, his friend told him that he was himself the

author of the work. "And here," exclaimed Barry, taking a bundle of papers from his pocket, "is the very copy I made of it, with my own hand." All the truth that there probably is in this story, is, merely, that Barry quoted Burke's own essay, in reply to some of that gentleman's arguments. He could hardly have been ignorant that Burke was the author of the work, which had been published so far back as 1757, at least five or six years before the interview in question is stated to have occurred.

But Burke did not satisfy himself with merely bestowing upon his young countryman the patronage of his favorable regard. Although, at this time, his income was an extremely limited one, he most generously undertook to provide the means of sending Barry to Italy, and supporting him there, while he nourished and matured his genius, by the study of the works of the great masters. Accordingly, after he had been seven or eight months in Dublin, the young artist proceeded, at Burke's invitation, to London, where the latter now resided. For a short time, he was occupied in making copies of some paintings, in oil, for James Stuart, the author of the 'Antiquities of Athens;' an employment which Burke procured for him, and which was well calculated to improve him in his art. In the end of the year 1765, he left London, for the Continent, and, passing through France, proceeded to Rome. He remained absent from England, about six years in all, during the whole of which time, Burke, assisted by his two brothers, supplied the funds necessary for his support. During his residence at Rome, Barry was not idle,—that, with all his faults, he never was at any time of his life,—but his studies were not always directed so wisely as they might have been, to the object which he ought to have had principally in view; and his unfortunate temper involved him in continual quarrels with his brother students. He received from Burke the best advice, administered in the kindest manner; but all failed to have much effect.

He made his reappearance in London, in the beginning of the year 1771, and immediately proceeded to

give proof of his improved powers, by painting some pictures, which he exhibited. But it was not his fortune, to meet with much applause. All his performances were characterized by certain obvious defects of execution, which struck every body, while their merits were frequently not of a kind to be appreciated by the multitude. Among other pictures, he painted one, in 1776, on the death of Wolfe, in which, as had been usual in such pieces, the combatants were represented naked, it being, in those days, held impossible to preserve any heroic effect, where modern costume was introduced. But just at this time, West produced his noble picture on the same subject, in which all the figures were painted, dressed as they had actually been; and the force of nature and truth triumphed over the scruples of criticism. Barry's performance was found quite unequal to sustain any competition, in point of attraction, with its rival. This and many other disappointments he had to bear; nor were those the least of his vexations which he brought upon himself by his own absurd and ungovernable temper. He had been, before this time, chosen an Associate of the Royal Academy, but he had already quarrelled with the Council. His wayward and ungrateful conduct at length well nigh tired out even the friendship of Burke. To add to all this, his pencil, his only resource, brought him but the scantiest returns; and his days were darkened by the miseries of severe poverty.

Yet all did not crush his spirit. While struggling with these complicated distresses, he continued to worship his art, with as warm an enthusiasm as ever. In a letter, written when he was in Italy, to his friend, Dr. Hugh, he had said, "My hopes are grounded in a most unwearied intense application; I every day centre more and more in my art; I give myself totally to it; and, except honor and conscience, am determined to renounce every thing else." In addressing himself, about the same time, to another friend, he exclaims, in touching anticipation of the fate that awaited him, "O! I could be happy, on my going home, to find some corner, where I could sit down, in the middle of my studies, books, and casts after the

antique, to paint this work and others, where I might have models of Nature when necessary, bread and soup, and a coat to cover me." He had now hardly the prospect of securing even these humble accommodations, when he nevertheless determined, for the honor of historic painting, to devote himself to the accomplishment of a great work, requiring much time and labor, and holding out to him at the best only a scanty, distant, and precarious remuneration. He proposed to the Society for the Encouragement of Arts, Manufactures, and Commerce, to adorn their great room, in the Adelphi, with a series of compositions on some appropriate subject, by his own hand, on condition only of being allowed to choose his subject, and of being provided with the necessary canvass, paints, and models. This was in the year 1777. He had just before published an elaborate work in refutation of the theories of some continental critics, who had maintained the impossibility of the higher style of art ever flourishing in England, on account of the climate being too northerly and cold; and he now thought himself bound, he informs us, to follow up his argumentative vindication of the national genius, by a proof of what it could produce, "in duty," says he, "to the country, to art, and to my own character." He calculated that this work would cost him the constant labor of two years, and he knew that he must, during all that time, procure himself the means of existence, by additional toil, in hours stolen from sleep. But the prospect of these things, had no power to deter him. With only sixteen shillings in his pocket, he entered upon his undertaking, determined, if only life should be granted him, to accomplish it, upon the terms he had proposed.

And he would probably have been able to keep to the letter of his engagement, if the work had cost him no longer time, then he originally contemplated. But, although he labored diligently and unceasingly, he found it impossible to finish it, in less than six years, instead of the two which he had thought would be sufficient. The subject, which he chose, was the Progress of Human Improvement, which he represented in a series of six pic-

tures. Of these, he intended the first to be emblematical of the savage state, or rather of the earliest dawn of civilization, when the chase was the only employment of men, and their rude natures were just beginning to be attempered to the influences of religion, law, and music; the second, of the age of agriculture; the third, of the establishment of civil polity, and the reign of literature, science, and the arts; the fourth, of the modern triumphs of navigation; the fifth, of the age of manufactures and commerce; and the last, of Elysium, or the immortal happiness of the great and good in a future state of existence. The conception of these different compositions displays considerable learning and ingenuity; but the subject attempted to be illustrated scarcely lies, perhaps, within the legitimate province of painting. At any rate, it has been generally felt, that Barry's allusive groups and figures, often shadow forth but very dimly and imperfectly what he means them to represent; and, indeed, that without his own printed explanations they would be sometimes nearly unintelligible.

If, however, he overrated his own powers, or those of his art, in undertaking this task, the manner in which he prosecuted and accomplished it, (in so far as he found its accomplishment possible,) must be allowed to form as fine a display of zeal, disinterestedness, self-denial, and heroic perseverance, as is any where to be found on record. During the six years which he was employed in the execution of these pictures, the enthusiastic artist led, voluntarily and contentedly, a life of incessant toil and privation. Wearing, as usual, the coarsest clothes, and living upon the humblest fare, his limited personal expenses still compelled him, not unfrequently, after working ten hours at the Adelphi, to sit up half the night, painting or engraving something for the booksellers, with the price of which he might purchase bread for the following day. At last, however, he was obliged to make an application to the Society of Arts for some assistance to enable him to continue his labors, and, after some delay, they voted him a hundred guineas. They also presented him with two hundred guineas, more, on the conclusion of his undertaking,

and permitted him to exhibit the pictures to the public, by which he realized about five hundred pounds. These sums, together with about two hundred and fifty pounds more, which he derived from the admiration of a few affluent individuals, formed all the remuneration he received for his six years' labors; but, inadequate as it was, it was more than he had counted upon. It deserves to be mentioned, to the credit of Barry's prudence, that as soon as he obtained this money, he placed it in the funds, not having, it would appear, even during the long period he had existed almost without any income at all, incurred any debts which it was now necessary for him to discharge. He thus secured an income, for the rest of his life, which, although small, was an independence to a person of his economical habits; and, indeed, added to the fruits of his daily industry, it enabled him afterwards to save money.

Barry lived for many years, after the completion of these paintings at the Adelphi, during which, he continued his studies and his professional labors as assiduously as ever, and although not much encouraged by popular favor, produced numerous works of various degrees of merit. While yet engaged with his great undertaking, which has just been described, he was elected Professor of Painting to the Royal Academy; and, as soon as he had finished the pictures, he commenced his lectures. He, also, in the course of his life, published various literary works, which, together with his Lectures and Correspondence, have been collected since his death, and form two volumes quarto. He died in February, 1806, having been suddenly attacked by a pleuritic fever, which carried him off, in a few days, in the sixty-fifth year of his age.

The biographies of many men are as instructive from the details which they present of the unhappy consequences that have flowed from errors of conduct or constitutional failings, as those of others are from their pictures of success won by merit. To the young and inexperienced, lessons of warning are as necessary as lessons of encouragement. It often happens, that great excellences are

combined, in the same individual, with great defects; and it is exceedingly requisite that, while he is taught and made to feel what may be accomplished by a due application of the one, it should also be deeply impressed upon him that the other, if indulged or allowed to remain uncorrected, may render the best abilities, and even the most arduous exertions, useless. The utter insufficiency of mere talent, indeed, to attain either independence or honorable distinction, when unaccompanied by habits of industry and perseverance, has been too often exemplified, to make it necessary that we should cite any instances in proof of it. Even the highest powers, unemployed, must remain unproductive.

But the history of Barry illustrates another case, which also sometimes occurs,—that of a person, who, uniting great capacity and unwearied application, still fails in obtaining the success he might have expected, from the want of other qualities. The deficiencies and mistakes of this able man, were chiefly such, as are peculiarly apt to mark the temper and conduct of persons, who, in early life, have been entirely or principally their own instructers. Such persons, before entering the real world, in which they must mix with their fellow-men, have commonly created, as it were, around themselves, a world of their own, to which all their notions and habits are accommodated, having been there, in fact, formed and learned. Their associates, in ordinary life, have not hitherto acquired any of their respect, by having guided or assisted, or even participated with them in those studies which they have pursued with so much ardor. They have here had to do every thing for themselves, and have found themselves sufficient for every thing. From all this, naturally springs some weakness, as well as much strength. On the one hand, proceed an independence and self-reliance, both moral and intellectual, begetting generally a manner of thinking unusually manly and unprejudiced, and sometimes considerable originality of view. But, on the other, arise an ignorance of the actual world and of mankind, an undue impatience of and contempt for, the ordinary conventional forms and arrangements of society, (which are all

founded upon the principle of mutual concession among many variously fashioned or variously feeling minds,) a bigotry in favor of certain peculiar notions, which will brook neither contradiction nor advice; in one word, such an excess of the spirit of confidence and aversion to control, as amounts, sometimes, to positive perversity and wilfulness.

The character of Barry exhibited, in strong relief, both the good and the bad qualities we have mentioned. The love of his art, was with him a passion. He pursued, throughout his life, the study and the practice of it with a zeal and a laborious application, which no difficulties and no discouragements could abate. He possessed, in sufficient measure, that trust in his own powers, without which, nothing great can be either achieved or attempted. And he both thought and wrote, with a force and decision, which showed a mind unenervated by the habit of taking its opinions from others, and capable of stamping its own impress upon whatever subject it investigated. But this masculine energy and hardihood of nature, from having been allowed to grow up undisciplined, very early degenerated into a species of recklessness and ferocity, which proved the blight of his genius and the curse of his existence.

His arrogance and infirmity of temper, as well as his imprudence and his extraordinary ignorance of the world, showed themselves, almost in the very commencement of his career. Scarcely had he set his foot in Rome, when he discovered, (to his own satisfaction,) that all the principles and maxims there recognised, with regard to the art he came to study, were stupidly wrong, and he forthwith not only denounced them as such, but quarrelled with every body who chose to stand up in their defence. It is possible that he may have been right in this judgement; but somewhat more of forbearance in the expression of it, and of toleration for the opposite opinion, would have savored both of charity and of wisdom.

From something of the same spirit of opposition and contumacy, he would not, while here, pursue the same method of study as his brother artists; but, instead of

employing himself in making drawings of the works of the great masters with his hand, he satisfied himself with taking facsimiles of them by an instrument. He even spent much of his time, as we have already mentioned, in the investigation of subjects, hardly connected, at all, with his proper occupation. All this while, he had, in his friend Burke, an invaluable monitor, whose counsels continued to be tendered to the last with a frankness, and, at the same time, a delicacy in the manner, only equalled by the admirable wisdom of the matter. But, although he felt the kindness, and, at times, even the good sense, of the advice he received, it certainly produced no effect upon his conduct.

On his return to England, as we have seen, he acted in the same manner as he had done at Rome,—attacking and quarrelling with every body, insisting upon having his own way, in every thing, too often apparently out of a spirit of selfishness or the mere love of dispute and opposition, and, in short, in his whole conduct regarding nothing, save his own humors and impetuous impulses. To deport himself after this fashion, he seems to have thought was a privilege he possessed, as a man of genius; —a weak mistake, which, if his genius had been of the highest kind, he never would have fallen into. How much truer a wisdom, than that which his own ill-regulated temper and childish notions of dignity suggested to him, might he have found, in a few sentences of one of the letters addressed to him, by Burke, a short time before he returned from Italy: "Believe me, my dear Barry," writes this considerate friend, "that the arms, with which the ill dispositions of the world are to be combated, and the qualities by which it is to be reconciled to us, and we reconciled to it, are moderation, gentleness, a little indulgence to others, and a great deal of distrust of ourselves; which are not qualities of a mean spirit, as some may possibly think them, but virtues of a great and noble kind, and such as dignify our nature, as much as they contribute to our repose and fortune; for nothing can be so unworthy of a well-composed soul as to pass away life in bickerings and litigations; in snarling and scuffling with

every one about us. Again and again, my dear Barry, we must be at peace with our species, if not for their sakes, yet very much for our own."

England has recently lost a distinguished painter, whose name it will be expected that we should notice here, as being that of one, who, like the others we have mentioned, also acquired his art without an instructer—we mean the late Sir THOMAS LAWRENCE. The boyhood of this great artist exhibited almost as remarkable an instance of the precocious developement of talent as any on record. He was born in 1769, being the youngest of a family of sixteen children. His father had been bred an attorney, but had afterwards become an excise officer, and, when his son Thomas was born, was an innkeeper at Bristol: which city, however, being unsuccessful in his business, he left, a few years subsequent to this event, and established himself in the same capacity at Devizes. He appears to have been a strange character, as, indeed, this outline of his history would itself lead us to suppose. His ruling passion, it seems, was a love of poetry; and this he carried so far as not only to spend much of his own time in writing verses, but often to insist that his guests, also, should postpone all other affairs, to listen to his effusions. How he found this sort of treatment to answer, in attracting or attaching customers to his house, may be easily conceived. All who did not prefer such intellectual banquets, to more substantial fare, gradually deserted this rhyming innkeeper, by whom, of course, many matters of considerable, though merely terrestrial, importance, were apt to be neglected, while he was employed in the service of the muses. The consequence was, that in six or seven years, this second speculation also failed, and old Lawrence was once more ready for a change of residence, if not of profession.

Long before this, however, his son Thomas had become famous in the neighborhood as a little prodigy. He was a very beautiful boy, and had been remarkable from infancy for his sprightly and winning manners. His father, whose favorite he was, had early taught him to recite poetry; and when the child was only four or five

years old, it was common for him to be presented, by his partial parent, to all strangers who visited the house, to exhibit to them his proficiency in this accomplishment. But, even at this very early age, he had acquired considerable mastery in an art more difficult than that of spouting verses. He was able, already, to use his pencil, and to take likenesses. This art he had acquired entirely of himself—if we should not rather say that, appearing as it did with the very commencing developement of his intellectual powers, it was more a faculty born with him than an art which he had to learn. It was several years, after he began to draw, before he had an opportunity of seeing a good painting. He had not only, therefore, to form himself merely by copying Nature, but to invent the mechanical processes of his art by his own ingenuity, without either a master or a model. Yet the portraits which he sketched, even so early as his fifth year, are affirmed to have been generally happy likenesses; and one of Lady Kenyon, which he executed at this period, is particularly recorded, as having been at once recognised, when shown to a friend of her ladyship, twenty-five years after.

At the age of six, he was sent to school, but he was only allowed to remain two years; and this, with the exception of a few lessons, in Latin and French, some time afterwards, was all the education he ever received. The uncommon talents he had displayed, had now made him generally known; and one gentleman generously offered to defray the expense of maintaining him for some years in Italy, that such extraordinary natural powers might not be deprived of the advantages of the best possible cultivation. But his father had very absurdly taken it into his head that instruction would only cramp and weaken his son's genius; or, at least, he chose to say that such was his opinion; and, upon this pretext, he not only refused to permit him to go to Rome, but would not even hear of his taking lessons, from a master, in his own country. He allowed him, however, to visit the houses of some of the neighboring gentry, where he saw some good pictures; and these, first gave him an idea of his-

torical painting. He copied various pieces of this class, and at last produced several original compositions of his own.

His father had, probably, for some time before leaving Devizes, resolved to make an attempt to turn his son's singular talents to some account; and it may have been partly with this view that he declined allowing any lessons to be given to the boy. He considered, of course, that he would attract more wonder by being presented to the public as an entirely self-taught genius, than if it should have to be acknowledged that he had derived any part of his skill from the instructions of others. When Mr. Lawrence gave up his inn at Devizes, Thomas was about ten years of age. The whole family immediately proceeded to Oxford. As soon as they arrived in this city, the boy's qualifications were announced; and numbers soon thronged to him to have their likenesses taken. The commencement of the speculation was thus sufficiently successful. From Oxford, they removed to Salisbury, and thence to Weymouth; and at both places, the talents of the young artist reaped a considerable harvest. At last, in 1782, Mr. Lawrence proceeded with his son, and the rest of his family, to Bath, where he proposed to fix his future residence. Thomas was at this time in his thirteenth year.

On his arrival in Bath, he found the persons of distinction, assembled in that fashionable place of resort, familiar with his name and his extraordinary abilities; and sitters soon came to him, in such numbers, that he raised the price of his crayon portraits, from a guinea to a guinea and a half. Some of the persons, by whom he was noticed, also, possessed valuable collections of pictures, and these he used to employ much of his time in studying and copying. Among other copies which he made was one of the Transfiguration by Raphael. This he sent to the Society of Arts; and although, in consequence of an informality, it was found not to be admissible as a competitor for any of the regular prizes, the Society were so much struck by its merits, that they bestowed upon the young artist their large silver palette, gilt, and five guineas in money.

He remained at Bath, about six years; and, during the whole of this time, young as he was, he was the sole support of his father and the rest of the family. He is said to have worked regularly in painting portraits at least four hours every day; besides which, he spent much time in studies and voluntary exercises connected with his art. At last his father, to whom he had so long brought a considerable income, either thinking that his labors might be made still more profitable, in a larger field, or perhaps prevailed upon by the remonstrances of the young man, himself, determined to remove his establishment to London. The family arrived there, in 1787, when Thomas was in his eighteenth year. His going to London, at this time, was undoubtedly a fortunate event, in every way, for the artist. The folly, or more interested views, of his father, had hitherto withheld from him all the ordinary means of improvement, in his profession; but he, himself, it is understood, with more good sense, felt anxiously desirous to be able to avail himself of better opportunities of study, than he could enjoy in the country. When he found himself in London, accordingly, he hastened to procure admission as a student at the Royal Academy. He also got himself introduced to Sir Joshua Reynolds, to whom, then in the height of his fame, his father would seem to have intended that he should at once set up as a rival; having, in the first instance, established him in an expensive suite of apartments in Leicester square, in the immediate neighborhood of the rooms of the great painter. In this matter, also, however, his son acted more modestly, and more wisely. He sought access to Sir Joshua's study, with one of his performances in his hand, submitted the picture to his inspection, and listened to his remarks, with the attention and deference of one who both knew their value, and how to profit by them. He also very soon removed from Leicester square, to less splendid lodgings in Tavistock street, Covent Garden.

Such was the early history of Sir Thomas Lawrence. His subsequent career, as all know, was one of great brilliancy. He was elected a Royal Associate in 1791.

On the death of Sir Joshua Reynolds, the following year, he was appointed his successor in the offices of painter to his Majesty and to the Dilettanti Society. From this time, his reputation grew steadily, till he came to be generally acknowledged the first portrait-painter of the age. In 1815, the honor of knighthood was bestowed upon him, by the Prince Regent. The preceding year, on the visit of the foreign Sovereigns to England, he had received his Royal Highness's commands to take the likenesses of these personages, and some of the more distinguished individuals in their suite; and, during their stay, he finished the portraits of the King of Prussia, Field-marshal Blucher, and the Hetman Platoff. Four years afterwards, on occasion of the Congress at Aix-la-Chapelle, he repaired to that city, where he painted the Emperor Alexander; and, proceeding thence to Vienna, he there completed portraits of the Emperor of Austria, the Archdukes, Prince Metternich, and other distinguished persons belonging to that court. From Vienna, he went to Rome, where he arrived in May, 1819. Here he painted the Pope, Pius VII. and Cardinal Gonsalvi. He remained in Rome, for several months, during which, he received the most gratifying testimonies of respect and admiration, from his brother artists, there, and it was the month of April, 1820, before he returned to England. The very day before he arrived in town, he had been unanimously elected to the Presidency of the Royal Academy, as successor to Mr. West. This distinguished office, he continued to hold, till his sudden and lamented death, on the 7th of January, 1830. Only the day before this event happened, he had worked for some time in his study, as usual; and even a few minutes before he expired, he had been conversing cheerfully with some friends, who had spent the evening with him, on the art which he loved, and which it was then little thought, by any of them, he would so soon cease to adorn.

Gifted as he was, with such an extraordinary natural capacity for his art, as to have been in reality a miracle of precocity, Sir Thomas Lawrence does not furnish us with an example, so valuable as many others we have

quoted, with reference to the peculiar object of the present work. His first acquisitions, in the line in which he afterwards so greatly distinguished himself, were not made either through laborious application, or in the face of any uncommon difficulties; but rather by a happy innate skill and facility, which enabled him to paint and draw likenesses, almost as soon as his hand could hold a pencil, and with something approaching to the same unconsciousness and absence of effort, with which, in other men, the limbs obey the impulse of volition, in their most ordinary movements. But still his history is not altogether uninstructive, even as a lesson on the subject of the pursuit of knowledge. Although, in his earliest efforts, he met with no opposition, but on the contrary, with abundance of encouragement and applause, from his father, we have seen the resistance which that person afterwards offered, to every plan which was proposed for his son's improvement; and it is to be taken, therefore, as an evidence both of great good sense, and no ordinary firmness, on the part of the son, that, not intoxicated either by the flatteries which had been lavished upon him, or by the decided success which had crowned even his yet imperfect performances, he felt, what his parent did not, how useful, study and instruction might be to him; and, as soon as it was in his power, took measures, of his own accord, to secure both. Had this eminent artist, indeed, not possessed many other superior qualities, besides his talent as a painter, the education which he received in his boyhood, suited as it was to force out his genius into brilliant but premature display, would, in other respects, have been productive of very unfortunate effects on both his professional and his general character. He must have been very active, in availing himself of such opportunities as his after life presented, for repairing the injuries of his early training.

He is one of a very few of the great English painters, (Gainsborough was another,) who have attained to eminence in their art, without having enjoyed the advantage of an early residence in the country which contains the principal works of the great masters. Sir Thomas Law-

rence never visited Italy, till he went there, as we have mentioned, on his return from Vienna, in 1819, when he was fifty years of age. This was one misfortune, which he owed entirely to the obstinacy of his father. Considering the very scanty education, too, which he received in the ordinary branches of learning, the respectable measure of literary information, of which he afterwards made himself master, deserves to be mentioned to his credit. Although not what is commonly called a scholar, he was well acquainted, we are told, with the best English authors; and had taken great pains to obtain a knowledge of classical and foreign works, in so far as they were accessible to him through translations. Finally, the sober and rational equability of temper and conduct, so opposite both to the low excesses of Morland, and the morbid cynicism of Barry, which this distinguished artist preserved throughout his life, notwithstanding his early exposure to so many influences, well calculated to corrupt both his understanding and his heart, forms another ground, on account of which his example is exceedingly worthy of being held up, to the imitation of all, and especially of such, as may have to tread a path so perilous as his, in the commencement of life.

CHAPTER VII.

Painters, continued: Giotto; Batoni, Greuze; Ehret; Solario. Other Cultivators of the Fine Arts: Canova; Bewick, Wood Engraving.

If we were to go over the long catalogue of painters, we should find many names to add to those we have already enumerated, of individuals, who have attained the highest distinction after acquiring their art originally without a teacher, or practising it, for a considerable time, in unnoticed obscurity. Giotto, for instance, one of the great revivers of the art in the beginning of the fourteenth

century, was the son of a peasant in the village of Vespignano, near Florence, and was employed, when a boy, in tending sheep. While in this condition, he was one day found by Cimabue drawing the figure of one of his flock on a large stone which lay on the ground; and that master, (the first who practised any thing deserving to be called painting in modern Europe,) was so much pleased with this attempt, that he took the boy with him to Florence, and carefully instructed him in his art, in as far as he knew it, himself. Giotto afterwards greatly surpassed his master, and, indeed, had no equal in his own age, either as a painter or a sculptor.

To descend to much later times, BATONI, the principal artist whom Italy produced, in the last century, taught himself painting, while working with his father, as a goldsmith; and, although he afterwards went to study at Rome, (being sent there by some admirers of his genius, who subscribed to defray the expense of his residence,) he merely availed himself of this opportunity to copy some of the works of the great masters, and to pursue the acquisition of his art under the direction of his own taste and judgement.

His contemporary, GREUZE, whom the French reckon their most eminent portrait-painter of that day, and who obtained, besides, great fame, for his compositions from humble life, was likewise a self-taught artist. Having begun at a very early age, we are told, to cover the walls and furniture of the house, with his sketches, he was strictly forbidden, by his father, to continue that amusement. But the bias of his genius, was too strong for the paternal interdiction; and he was again and again found with his chalk or charcoal in his hand, and busy at his old employment. At last, one day, when his father had been scolding him, on this account, a painter, of the name of Grandon, from Lyons, happened to pay them a visit; (they lived in the town of Tournus, in Burgundy, at no great distance from that city;) and it was agreed, by all parties, that young Greuze should be taken home, by him, to Lyons, and regularly instructed in the art, to which he had shown so strong an attachment. It is affirmed however, that he was already nearly as good a painter as the master

to whom he was thus consigned, and that, in his subsequent progress also, he was chiefly his own instructer.

Another artist, of the same period, distinguished in a different line, GEORGE DIONYSIUS EHRET, whose admirable drawings, of botanical objects, are so well known, from the engravings in the *Hortus Cliffortianus*, and other splendid works, was the son of a working gardener, employed in the gardens of one of the minor German princes, and, when a boy, acquired his skill in delineating flowers, so entirely by his own efforts, and, it may be even added, with so little consciousness of the progress he was making, that he had formed a valuable collection of the productions of his pencil, before he was aware that his labors were worth any thing. Dr. Trew, a physician of Nuremberge, had accidentally heard of him; and, having desired to see his drawings, found that he had already executed representations of about five hundred plants, in a style of extraordinary excellence. These paintings had been merely the amusement of the young and self-taught artist; and his surprise may be conceived, when Dr. Trew offered to purchase them from him, for four thousand florins, or above two hundred and fifty pounds sterling. Even the money was not so welcome, as the assurance thus given him of the value of a talent, which he had hitherto rated so lightly. Ehret, who from this moment determined upon making botanical drawing his profession, eventually, as we have mentioned, earned the highest distinction in this line of art, especially after the intimate acquaintance he formed with the celebrated Linnæus, who directed his attention to the importance of minute fidelity, in delineating some of the details of vegetable nature, which he had been accustomed too much to overlook. After having resided in different parts of the Continent, he went to England, in 1740, when he was about thirty years of age, and remained in that country, till his death, in 1770. He had educated himself, diligently, in other branches of literature and science, as well as in those immediately connected with his profession, and had been a Fellow of the Royal Society, many years before his death.

To these instances, we may add the strange and ro-

mantic story of the Italian painter, ANTONIO DE SOLARIO, commonly called Il Zingaro, or The Gipsy, to which, after it had been long almost forgotten, attention has been recalled, in consequence of the discovery of one of the artist's paintings, at Venice. On this painting, which was purchased from a dealer by the Abbé Louis Celotti of that city, Solario designates himself a Venetian; and the circumstance appears to have been received as matter of no small gratification and triumph, by those who consider themselves as hence entitled to claim him as their countryman. A Signor Moschini has published a small pamphlet upon the subject, which he dedicates to the Abbé Celotti, and in which he details the particulars of Solario's history, as they are given in Bernardo Dominici's 'Lives of the Neapolitan Painters,' one of the few writers, by whom even his name had heretofore been noticed. Dominici, however, represents him as having been a native of the province of Abruzzo, in Naples; and Moschini therefore addresses himself, in the first place, to refute this error, as he conceives it to be, and to maintain the claim of Venice to the honor of having been the Gipsy's birthplace. His argument upon this point, though rather long, issues, after all, merely in a reference to the inscription upon the Abbé Celotti's picture, which, in the absence of all other direct evidence, he contends ought to settle the question.

But wherever he may have been born, it is agreed, on all hands, that Solario was originally a gipsy, or wandering tinker, and that it was in this character, he first made his appearance at Naples, in the beginning of the fifteenth century. He was, at this time, in the twenty-seventh year of his age, having been born, it is said, although about this date there is some doubt, in the year 1382. While here, he chanced to be employed to do some work, in the way of his craft, by a painter of the name of Colantonio del Fiore. This painter had a very beautiful daughter; the young lady was seen by Solario; and the tinker at once fell deeply in love with her. It was taking a bold step, certainly, and one not very likely to be successful; but, impelled by his passion, the enamored

Solario determined to ask the lady from her father, in marriage. His application was treated with ridicule, by Colantonio; who, by way of effectually extinguishing the poor gipsy's hopes, told him that he meant to bestow his daughter only upon some one who was as good a painter as himself. Then will you accept of me, said Solario, for your son-in-law, if, after a certain time, I shall present myself to you with that qualification? Will you give me ten years to learn to paint, and so to entitle myself to the hand of your daughter? Colantonio thought that he would not hazard much by assenting to this proposal, by which he would at least rid himself, for the present, and for a considerable time to come, of his importunate suitor, whose pertinacity and earnestness began somewhat to alarm him; and so, not greatly apprehending that he should ever hear more of him, he assured the tinker, that, if he came back, within the period in question, transformed into a painter, the young lady should be his.

Before this, the story relates, Solario had, by some means or other, obtained the attention and favor of the king's sister; and he now insisted, that Colantonio should go with him to that princess, and, in her presence, renew his covenant. Somewhat more favorably impressed towards his proposed son-in-law, probably, by being made aware of the interest he had at court, the painter agreed to this also; and the princess accordingly became the witness of the solemn ratification of his engagement. Having settled the matter thus far, Solario immediately left Naples, for Colantonio had stipulated that he should remove to a distance while acquiring his new accomplishments; and, in the first instance, he proceeded directly to Rome. Here, however, he could not find an instructer to his mind; but he heard much talk of Lippo Dalmasi, who resided at Bologna, and thither, therefore, he determined to betake himself. On finding Lippo, and telling him his object, he received at first, from that person, only an urgent exhortation to think no more of so wild a plan, and to trust to the efficacy of time and absence to cure his passion; but Solario continued to press his application so perseveringly, employing even tears to aid his entrea-

ties, that the reluctant painter was at last prevailed upon, to admit him as his pupil. To the ardent Solario, it now seemed as if all his difficulties were over. From the moment in which he began to receive Lippo's instructions, his application was unceasing. Awkward as he was, at first, he soon became the admiration and envy of his fellow-students; and even his master himself now advised him to persevere in his new career, as earnestly as he had formerly endeavored to dissuade him from entering upon it. He remained six or seven years with Lippo, and then left Bologna to visit the other principal towns of Italy, with the view of improving himself in his art by studying the various styles of other painters.

In this peregrination, he spent nearly three years, during which, he visited, among other places, Florence, Ferrara, and Venice; and then, returned once more to Naples, after an absence of nine years and some months. He first presented himself to one of the gentlemen, attached to the court, whose picture he drew, and by his means he was introduced to the presence of his old friend, the princess, who would seem, by this time, to have ascended the throne. Changed, as he was, in outward appearance, as in every thing else, he was not recognised by his former patroness; but a Madonna and Child, of his own drawing, which he offered to her, was graciously accepted. When her majesty had expressed her approbation of this picture, the painter threw himself at her feet, and ventured to ask her if she did not recollect the wandering gipsy, who ten years before had had the honor of being admitted to her presence, and in whose fortune she had then been pleased to take an interest. After recognising him, the queen, at first, would scarcely believe that he had really painted the picture he had given her; but on his executing, in her presence, a portrait of herself, she no longer doubted the truth of his pretensions. She then sent for Colantonio, and, having submitted the pictures to his inspection, desired him to tell her what he thought of them. Colantonio extolled them both to the skies. On this, her majesty asked him, whether he would not rather give his daughter to the artist whose productions were now before him,

than wait any longer for the return of the gipsy, of whom he had heard nothing for so many years? Too glad of such an opportunity of escaping from his engagement, the Neapolitan painter eagerly expressed his assent to this proposal; when her majesty, calling to Solario to step forward from his place of concealment behind a curtain, where he had heard all that passed, at once solved the mystery. We need scarcely add the conclusion of the story. Solario received his well-earned bride; the father, as he put her hand in his, remarking, that, if not his ancestry, at least his art deserved her. Solario was, soon after this, appointed painter to the Neapolitan Court.

During the remainder of his life, he executed many works, which placed him in the very first rank of the painters of that age. In particular, his series of pictures in *fresco*, illustrative of the life of St. Benedict, in the church of the convent of St. Severinus, at Naples, long excited universal admiration; and, even in the half-defaced state in which they at present exist, testify the extraordinary powers of the artist. These frescoes, however, he left unfinished at his death, in 1455. The picture, by Solario, which the Abbé Celotti recovered, and of which an engraving is given in Signor Moschini's pamphlet, is considered as fully sustaining the artist's traditionary fame. As for the history, which we have just detailed, it is not improbably indebted to the popular love of the marvellous, for some portion of the shape in which it has come down to us; but there can be little doubt that it is, in the main, founded upon fact. The reader will remark some similarity to that of Matsys, the Flemish painter, whom we mentioned in our former volume;* and, if both relations be true, seldom, certainly, has love had to boast of a greater or worthier triumph than those it achieved in the cases of the Italian tinker, and the blacksmith of Antwerp.

But we cannot afford to notice any more of the numerous instances, suitable to our purpose, which the biography of painters would supply. We shall mention only one name, from a kindred department of art—that of the eminent sculptor, CANOVA. He was also, in great part, a

* Vol. i. p. 60—62.

self-taught artist. Canova was born, in 1757, at a small village, situated in the Venetian territory. His father was a stone-cutter, and died when Antonio, who was his only child, was in his third year. His mother, in a few months, married again, and removing to another village, left the child, who was of a very delicate frame of body, with his paternal grandfather and grandmother.

This turned out by no means the most unfortunate thing that could have happened to Antonio; for his grandfather, whose name was Pasino, although only a stone-cutter, was a man of very great intelligence and ingenuity, and, by all accounts, much better qualified, at least to kindle to its first love of art, the genius of the future sculptor, than his own father, had he lived, would probably have been. Pasino's wife Catherina, too, took the most tender care of her little grandson. He was, indeed, the delight of the good old people; and, while he was yet almost a child, Pasino, who, as we have just said, was accomplished much beyond the generality of his class, had taught him the elements of drawing, and had even set him to model in clay, and to shape little fragments of marbles into the figures of the more simple and easy inanimate objects. The young artist, on his part, had no delight any where but in his grandfather's workshop, unless it was, after the hours of labor, to listen to the tales and ballads recited to him by his grandmother. So early as his ninth year, indeed, Pasino employed him as a regular workman, and he continued to be so employed, till he was twelve.

During these three years, he had been often in the habit of accompanying his grandfather, to execute repairs at the houses of the neighboring proprietors, several of whom were Venetian noblemen, who had their country residences in this district. Among these, was the Signor Giovanni Falieri, a gentleman of cultivated taste, who, after having frequently seen the boy, was so much pleased with his manners, as well as the evidences of ingenuity which he already displayed, that he at last resolved to take him into his house, in order that he might enjoy some of those advantages of education, which his grandfather's humble means could not afford him. A story has been

told of Canova having first attracted the attention of the Falieri family, by his having, on one occasion, when some ornament was unexpectedly wanted for the Signor's table, modelled, for the purpose, a lion, in butter, which excited such admiration, that the artist was immediately inquired after, and orders given that he should be brought forward. But it appears certain, that this anecdote is a fable, in so far, at least, as it attributes the introduction of the sculptor to his early patron, to the circumstance in question.

Pasino, as we have said, had been long known to Signor Falieri, who had also had many occasions of remarking the promising talents of his grandson, before he took him into his house.* That step, however, he appears to have adopted, with no higher views, at first, than merely that the boy's general faculties might receive such cultivation, as should enable him to follow the trade of his father and grandfather with superior advantages. Nor did he probably entertain any other intentions, with regard to the future destination of his *protégé*, when, after some time, he sent him to receive some instructions in the rudiments of sculpture, from an artist of considerable eminence, who then happened to be residing in the neighborhood, Giuseppe Bernardi, or Toretto, as he was otherwise called. In Toretto's workshop, however, Canova soon learned more, than it was ever intended that he should acquire.

After he had been there somewhat above a year, he one day took an opportunity, in his master's absence, to make models of two angels, in clay. When Toretto, on his return home, saw these figures, he could scarcely believe that they had been executed by his pupil, who had hitherto, in fact, received lessons merely in some of the mechanical processes of the art. Canova remained with Toretto, about three years, and then returned to his native village and his original occupation. But, fortunately, Signor Falieri, who now resided in Venice, seized, probably, by some misgivings as to the fitness of the humble

* *Vide* Memoirs of Antonio Canova, by J. S. Memes, A. M. Edin. 1825, pp. 153, &c.

sphere to which he had consigned the talents of his young friend, after a short time, again sent him an invitation to come to him. To Venice, accordingly, Canova repaired, being now in his sixteenth year. From this date, it may be considered, that it had been fixed, that he should become an artist. He therefore applied himself assiduously to all the necessary studies. In order, at the same time, that he might not be entirely dependent on his patron, although he lived in his palace, he formed an engagement to give his services, during the afternoon, to a sculptor in the city, although he got very little for his work. "I labored," says he, in one of his letters,* "for a mere pittance, but it was sufficient. It was the fruit of my own resolution; and, as I then flattered myself, the foretaste of more honorable rewards,—for I never thought of wealth." His day, therefore, was thus divided; the morning was given to study in the Academy or the Galleries, the afternoon was spent in the workshop, and the evening was devoted to the improvement of his mind in general knowledge.

The first commission, which Canova ever obtained, was from one of the Venetian noblemen, for two baskets, containing fruits and flowers. This, his earliest performance, is still to be seen at Venice; but it is not thought to give much promise of the excellence which he afterwards attained. After this, he proceeded to the execution of a group on the subject of Orpheus and Eurydice, for Signor Falieri; but this he did not finish till many years afterwards. Meantime he determined to set up in business for himself; and the first workshop of this great sculptor, was a small ground cell, in the Monastery of the Augustine Friars, the use of which he obtained, by a grant from the brotherhood. In this humble and obscure apartment, Canova wrought for four years. But, although not much noticed by the world, during this period, his mind was all the while making rapid progress in the study and mastery of his art.

It was at this time, that, left entirely in the pursuit of excellence to the guidance of his own reflections, he first

* Memoirs by Memes, p. 188.

began to perceive the necessity of founding the study of art upon the study of Nature, in opposition to the notion, which then prevailed, that certain assumed principles and rules of operation were alone to be attended to. As soon as this new view dawned upon his mind, he hastened to regulate his studies in conformity to it. Instead of merely examining and copying the works of other sculptors, he resorted for every part of his art to the works of Nature. He studied anatomy. He attended the public spectacles and the theatres, that he might catch the finest attitudes of the human figure, from the living exhibition. In walking the streets, in like manner, his eye was constantly on the watch, to catch new forms of grace and power, from the moving life around him. His art now became more than ever the sole object for which he lived. He laid down a rule for himself, which he strictly observed, never to pass a day without making some progress, or to retire to rest, till he had produced some design. In the mean time, he also pursued, with ardor, his studies in general knowledge, especially in those branches, which he conceived to be most important to him in his profession, such as poetry, antiquities, history, and the Greek and Roman classics, which, however, he could only read through the medium of translations. He also studied the French and Spanish languages. All this time, however, as we have mentioned, he was very little known.

The first performance, by which he attracted the notice of his fellow-citizens, was his finished group of Orpheus and Eurydice, which he exhibited in 1776. Immediately after this, orders began to flow in upon him, and he soon removed to a better workshop. In 1780, the Venetian senate bestowed upon him a pension of three hundred ducats, (about £60,) in order that he might have it in his power to go to finish his studies at Rome. From this time, the ecclesiastical capital became his chief residence. On his first arrival there, however, his novel principles of art, revolted all the established authorities in such matters; and for a long time his works were the ridicule both of connoisseurs and of his brother sculptors. It was not till about the year 1800, that Canova's merits

were fully and generally recognised. From this time, however, till his death, in 1822, he stood in universal estimation without a rival, and received all the honors that the admiration of the world could bestow upon him, as one of the greatest sculptors that had appeared, not only in his own, but in any age.

The last person we shall mention, under this head, is the late THOMAS BEWICK, so deservedly celebrated for his admirable performances in wood-engraving, an art, of which he may be said to have been, not so much the improver, as the reviver, or reinventor. Bewick was born in the year 1753, at a village called Cherryburn, in Northumberland. From his earliest years, he delighted, above all things, in observing the habits of animals; and it was his fondness for this study, that gave rise, while he was yet a boy, to his first attempts in drawing. Long before he had ever received any instruction in that art, he used to delineate his favorites of the lower creation, with great accuracy and spirit. His introduction to the regular study of his future profession, was occasioned by an accident similar to that which has been mentioned, in a former page, as having happened in the case of the French painter, Greuze. Bewick, also, was in the habit of exercising his genius, by covering the walls and doors of the houses in his native village, with his sketches in chalk. Some of these performances one day chanced to attract the attention of a Mr. Bielby, a copper-plate engraver, of Newcastle, as he was passing through Cherryburn; and he was so much struck, it is said, with the talent they displayed, that he immediately sought out the young artist, and obtained his father's consent to take him with him to be his apprentice. Mr. Bielby had not had his young pupil long under his charge, when the late Dr. Hutton, of Woolwich, happened to apply to him, to furnish a set of copper-plate engravings, for a mathematical work, (his Treatise on Navigation,) which he was then preparing for the press. Bielby, however, who was a very intelligent man, suggested to the Doctor, that, instead of having his diagrams engraved on copper, in which case they could only be given on separate plates,

to be stitched into the volume, it would be much better to have them cut in wood, when they might be printed along with the letter-press, each on the same page with the matter which it referred to, or was intended to illustrate. This, indeed, is one of the chief advantages of wood-engraving. In a copper-plate, as may be known to most of our readers, the parts, which are intended to leave an impression upon the paper, are cut into the copper, so that, after the ink is spread over the engraving, it has to be rubbed from all the prominent or uncut portion of the surface, in order that it may remain only in these hollows. Several disadvantages result from this. In the first place, the plate is very soon worn, or the fineness of the lines impaired, by this continual abrasion to which it is subjected.* Secondly, from the method of inking being so different from that which is used in printing letter-press, where the parts of the type that make the impression are the prominences and not the hollows, and the ink, therefore, is allowed to remain, where it naturally adheres, on being applied by the ball or roller, the copper-plate engraving must always be printed by itself, and generally on a separate page from the letter-press. The only way of giving both, on the same page, is to subject the paper to two successive impressions, which, besides the inconvenience of the operation, almost always produces an unpleasant effect from the difference of color in the two inkings, and the difficulty of adjustment.

A wood-cut, has none of these disadvantages. As the impression is to be made by the prominent parts of the wood, these, which receive the ink directly from the roller, are allowed to retain it, just as in the case of ordinary types; and there is therefore nothing of that process of rubbing, at every impression, which so soon wears out a copper-plate. The consequence is, that while rarely more than two thousand impressions can be taken from a copper-engraving, before it requires to be retouched, a wood-cut will yield perhaps fifty thousand. Then the latter, from the manner in which it is to be inked, admits of being set up, if necessary, just like any of the other

* Engraving on steel has very much remedied this disadvantage.

types, in the midst of a common page, and so of being printed both in the most convenient place and without any separate process. The block must, of course, for this purpose, be made very exactly of the same thickness or depth as the other types, along with which it is placed. In the early days of wood-engraving, the pear-tree or apple-tree was the wood most commonly used; but box-wood is now generally employed, as being of a still firmer and more compact grain. The surface of the block is first shaved very even and smooth; and upon this, the figure is then traced in pencilling, as it is to be finally cut out in relief.

Dr. Hutton followed Bielby's advice, with regard to the diagrams for his book, and it was arranged that they should be cut in wood. Many of them, accordingly, were put by his master into young Bewick's hands. The boy executed them with so much accuracy, and a finish so greatly beyond what had usually been attained in that species of work, that Mr. Bielby earnestly advised him to give his chief attention henceforward to wood-engraving, and to make it his profession. At this time, the art in question had fallen into the lowest repute. Yet it had by no means been always so. In former times, it had both counted several distinguished names among its cultivators, and had reached a very striking degree of effect, in some of its productions. About the end of the fifteenth century, the celebrated painter Albert Durer, who was also eminent as a copper-plate engraver, practised cutting in wood.

When the art was first introduced, it was employed, chiefly to furnish ornamental borders, for the title-pages of books; and these decorations, were, in general, merely broad stripes of black, enlivened by a few simple figures, such as circles or hearts, which were left white upon the dark ground, by being, not raised, but scooped out in the wood. In the same manner, when any object, the shape of a human or of any other being, for instance, was to be represented, it was the practice merely to cut away the block according to the requisite outline, leaving all the space within untouched, so that when inked and applied to the paper, it left its impression in a blot of unrelieved

and uniform blackness, throughout. The picture of the devil, in particular, used often to be exhibited in this sable, and, as many no doubt deemed it, in this case, peculiarly suitable guise. It soon, however, became usual to introduce white lines, effected, of course, by the easy process of merely cutting grooves in the wood, to mark the shades at the knees, shoulders, and other parts of the figure; and this improvement made the representation both less sombre and more natural. At a still later period, the outline, alone, and the shaded parts, were left prominent. This may be considered to have been the commencement of the existing style of the art.

But the period, during which wood-engraving was carried to the greatest perfection, was about the beginning of the sixteenth century, when a method was followed, by some of the more eminent artists, which gave to their performances an effect unattained by their predecessors, and which the best productions of succeeding times have perhaps scarcely surpassed. This was the method of cross-hatching, or the cutting of the wood into a congeries of squares or lozenges, by two series of prominent lines, running transversely to each other. By this means, they produced not only shading, but gradations of shading, with as much perfection as is done in copperplate engraving; for the different parts of the picture had only to be hatched more or less closely, according as they were intended to be dark or light. The difficulty, however, of carving these crossing lines, upon the wood, must have been exceedingly great; and, indeed, it has been supposed by some that the effect in question was produced by the paper being impressed, not upon one, but upon two, blocks, successively. The method of cross-hatching in wood has, at all events, been long abandoned; but some attempts, that have been made in very recent times, have shown, that it is perfectly practicable to produce the same effect as in the works of the old masters by a single block, although at the expense of extraordinary labor and skill. If the old method had consisted in any such half-mechanical process as the application of successive blocks, it probably would not have fallen so completely into ob-

livion. The extraordinary pains it cost, and the time it consumed, occasioned its disuse.

When the practice of cross-hatching was abandoned, however, wood-engraving may be said to have ceased to be cultivated as an art. In England it was seldom resorted to, except to furnish a few of the simple ornaments used in common printing, such as a border for the title-page, a tail-piece, or a coarse cut, to put at the head of a street ballad. From this state of contempt, it was raised again to the rank of one of the fine arts, by the genius and perseverance of the individual the mention of whose name has given occasion to this brief sketch of its history, and who, by his labors in its cultivation and improvement, raised himself, also, from obscurity to distinction. According to Mr. Bielby's advice, Bewick probably continued to give much of his attention to cutting in wood, during the remainder of his apprenticeship. As soon as it was over, he repaired to London, where he went into the employment of a person who practised this trade, such as it then existed, somewhere in the neighborhood of Hatton Garden. It is probable, however, that he soon found he was not likely to learn much from his new master; for, in a very short time, he returned to the country. With his taste, too, for rural scenery and enjoyments, and the observation of Nature, he found little in London, in which he took much interest. When Mr. Bielby, therefore, now offered to take him into partnership, he at once resolved to retrace his steps to Newcastle. Nor even after he had obtained his highest celebrity, did he ever again think of establishing himself in the metropolis. He spent the remainder of his life, in his native district.

The first specimen of his talents, by which Bewick made himself publicly known, was a cut of an old hound, which, being laid before the Society of Arts, obtained a prize, which they had that year offered for the best wood-engraving. This was in 1775. The block had been cut for an edition of Gay's Fables, which had been projected some time before, by Mr. Thomas Saint, the printer of the Newcastle Courant. The work itself appeared in 1779, and immediately attracted general attention by the

striking superiority of its embellishments, which were all from wood-cuts executed by Bewick and his younger brother John, who, when Bielby and he entered into partnership, had become their apprentice. From this time, the reputation of the artist went on increasing, steadily, and he produced a succession of works, which very soon gave altogether a new character to his art itself.

The work, however, which established his fame, was his 'History of Quadrupeds,' which appeared in 1790. He had been employed many years in preparing this publication, all the cuts in which, were not only engraved by himself or his brother, but were all copied from his own drawings. He had continued to cultivate his early talent for the delineation of animals with unwearied industry, having been in the habit of taking sketches of all the striking specimens that came under his notice; while, in order to obtain accurate representations of those of greater variety, he never failed to visit whatever menageries came to Newcastle, and there to draw them from the life. His assiduous studies from Nature, no doubt greatly contributed to the excellence of the cuts, in the 'History of Quadrupeds.' Many of the vignettes, also, with which this publication was adorned, had uncommon merit as original sketches; for Bewick did not confine his attempts with his pencil to the mere delineation of animals.

But Bewick was principally indebted, for the great superiority of his productions over those of his predecessors, to an entirely new mode of operation, which he introduced into the art. The secret of the old method of cross-hatching, as we have mentioned, had been long lost; or, at least, it had been entirely abandoned, from the extraordinary difficulty of the only known manner of practising it. But Bewick produced nearly the same effects by another, and much simpler contrivance. Till his time, the block, when prepared for the press, presented only two varieties of surface, the parts which were intended to receive the ink and make the impression being left in relief, while all the rest of the wood was cut away to so great a depth, as entirely to prevent it from touching the paper. The consequence was, that the dark portions of

the engraving were all of one shade, while the only other color introduced was the pure white of the paper. But Bewick effected a variety of tints, and thereby a much truer and more natural perspective, by leaving certain parts of his blocks not quite so prominent as those that were intended to produce the darkest lines, while, at the same time, he did not lower them so much, as altogether to prevent them from coming in contact with the paper, when applied to take off the cut. The portions of the surface, which were left in this state, communicated an impression, varying in depth of shade, according to the degree in which the wood was scooped away; and the cut thus exhibited upon the paper all the gradations to be found in a copper-plate engraving.

It is said, that this improvement was first suggested to Bewick, by his friend, the late Mr. W. Bulmer, (afterwards the eminent London printer,) who was a native of Northumberland, as well as himself, and, serving his apprenticeship in Newcastle, at the same time, used always to take off the proofs of Bewick's cuts. To the skill and contrivance of the artist, himself, however, we are doubtless to ascribe the first application and practical demonstration of the new method, as well as the subsequent improvements, by which he eventually gave to it probably all the perfection of which it is susceptible.

It would be out of place, in a sketch like this, to follow up what has been said, by a catalogue of the various works, which Mr. Bewick gave to the world, after the period in his history at which we are now arrived, or which made their appearance illustrated by his embellishments. We have traced the steps by which he rose, through the force of his own talents and industry, to the head of his profession; and it is not necessary that we should pursue his career further. Suffice it to say, that he amply sustained, throughout the remainder of his long life, the promise of his early progress. No man was ever more devoted to his profession. Its labors were as much his enjoyment as his business. He was always an early riser; and from the hour at which he got out of bed, till evening, he was generally to be found at work, and whis-

tling merrily all the while. For what are called the pleasures of society, he cared very little; his social hours were passed in the midst of his family, or occasionally among a small number of select friends, when the task of the day was done. Every thing in the least degree savoring of effeminate indulgence, he despised. His ordinary exercise was walking; but he was fond of all the manly and invigorating sports of the country, and desired no better relaxation, from the toils of the workshop, than an occasional participation in such cheap and simple amusements. The whole economy of his life, was regulated upon a principle of rigid temperance, as well as of the most steady and persevering exertion. He was remarkable, at all times, for the moderation with which he ate and drank; and in respect to other matters, he showed such a contempt for luxury, that he generally slept, even in the depth of winter, with the windows of his chamber open, though, in consequence, he sometimes on waking, found the snow lying on his bed-clothes. For money, which men in general prize so highly, Bewick had all the indifference of a philosopher.

The number of works which his unwearied application produced was, as might be expected, extraordinarily great. But he did not confine his studies and performances merely to the art, in which he has chiefly earned his fame. He made himself competently acquainted with various branches of knowledge; and with natural history in particular, he was intimately conversant. He also engraved, occasionally, on copper, as well as on wood. Even the greater leisure which he was obliged to allow himself, during the few last years of his life, when the infirmities of old age compelled him partially to relinquish his professional labors, was not given up to mere idleness. He availed himself of this release from his ordinary occupations, to write a memoir of his own life, which is said to be composed with much minuteness of detail, and to be of considerable extent. But to the very last hour of his existence, his art continued to occupy his thoughts. His last undertaking—directed, like most of those by which it had been preceded, mainly by an anxiety for

the diffusion of sound knowledge and morality—was the preparation of a series of cuts, for the laboring part of the population, which might supplant the tasteless and often corrupting prints usually found among the embellishments of the cottage; and a proof impression of the first of this intended collection, a cut of an old horse, heading an address against cruelty to animals, was brought to him, only two or three days before his death. This eminent artist and excellent man died on the 8th of November, 1828, in the 76th year of his age.

CHAPTER VIII.

Usefulness of such encouragements as the examples here given are calculated to afford to youthful genius in every department of study. Self-educated Poets:—John Taylor; Antonio Bianchi; Ramsay; Bloomfield; Duck.

THE individuals, with whom our last three chapters have been occupied, have not earned their distinction, by the cultivation of any branch of what is properly called science or literature; but their lives do not, on that account, furnish us with less suitable illustrations of the subject of the present work. Our object is to inculcate the importance, to demonstrate the practicability, and to point out the method, of intellectual improvement generally; and especially to make the young reader understand and feel, by an array of examples taken from every condition of society, and every walk of mental exertion, that, in the pursuit of any description of knowledge, no difficulties, arising from external circumstances, can eventually resist a steady determination to excel; so that a man's success or failure in such an attempt, depends, in fact, more upon himself, than upon any circumstances in which he may be placed. Wherever, therefore, we have been able to find a case of extraordinary attainments, made in despite of such obstacles as usually repress all endeavor

after intellectual cultivation, we have not hesitated to bring it forward, whether it was that of an individual who had distinguished himself in philosophy, in scholarship, or in art.

What we have wished to establish and make evident is, the power which every man, really desirous of education, has, in the absence of all aid from others, to educate himself; and that this power is not confined to the case of any particular sort of acquirement, but exists, in nearly an equal degree, in regard to every species of knowledge or skill, of which any one may be ambitious to possess himself. And one moment's consideration will show the vast importance of such a truth being generally diffused, and felt in all its universality.

From how much apprehension and despondency, would even those of the children of poverty and neglect, who have been eventually most successful in their efforts to educate themselves, been saved, had they all possessed such an assurance, as these examples are calculated to afford, that many others had triumphed in the same or a harder struggle, before them? Would not this, of itself, have helped to smooth the roughest of their difficulties, and carried them forward on their way with new strength, even when their hearts were most ready to fail them? Nay, how many might not such an assurance have led to high attainments, and perhaps to achievements, beneficial to themselves and to mankind, in some one of the various paths of intellectual enterprise, who, frightened by the apprehended arduousness of the task, have either never made an attempt to emancipate themselves from the ignorance in which they were reared; or, having begun the pursuit of knowledge, have stopped in their career, ere they had made any considerable progress? Nor let it be said that the mere force of talent, where it really exists, will of itself be sufficient to overcome every thing that may tend to repress it. Even genius, of the highest order, is often diffident, and easily dismayed; its quickness of sensibility makes it apprehensive, and prone both to exaggerate difficulties where they do exist, and to create them where they do not. On these accounts, it frequently needs encouragement, where a coarser nature, and facul-

ties of immeasurably less real power, might safely be left to make their way, without any pains being taken to invigorate or sustain their possessor's confidence of success. We cannot, then, doubt the usefulness of diversifying our illustrations, as much as possible, by selecting them from all the different departments of biography. We would offer to every aspirant, in every line of intellectual pursuit, an example, by which he may at least learn that he is setting out upon no impracticable or hitherto unaccomplished journey, but that a road as difficult as his own, if not the very same, has been travelled by another before him. Whether, therefore, it be literature or science, or any branch of art, in which it is his desire to accomplish himself, let him be as destitute at the commencement of his career of all the ordinary means of instruction, as he may, here is his assurance that the way is still open to him, not only to mediocrity of attainment in his chosen pursuit, but even, it may be, to the highest distinction.

We propose now to notice a few of the more remarkable instances, not already adverted to, in which a genius for another of the fine arts, Poetry, which is, however, at the same time, a department of literature, also, has burst through all the impediments of an unfavorable worldly lot, and prompted its possessor to the successful pursuit of that education, which here, as every where else, can alone enable even the most extraordinary native powers of mind to produce any thing of much value. For it is certainly a very unfounded, though by no means an uncommon, notion, that the case of poetic talent forms an exception to this general rule, and that to be a great poet, a man has only to be born such. There is no instance, on record, of an individual either securing or deserving any considerable or permanent distinction, by his poetical productions, who had not stored his mind with much and various knowledge;—in other words, who had not educated himself well, although he never, it may be, matriculated in any university. The germ of a genius for poetry, has, no doubt, sometimes made its appearance in individuals, nearly uneducated; but where is to be found the case of this description, in which the seed, so buried in an uncul-

tivated soil, has ever grown to any thing worth the gathering? It is, indeed, very much to be apprehended, that this mistaken notion, in regard to the uselessness of education, to a poet, which is sometimes carried so far, as to amount to a belief that a poet is actually spoiled, by being educated, has not unfrequently had the effect of preventing persons, who felt, or supposed, themselves to be gifted with poetic powers, from exerting themselves with so much ardor and perseverance as they otherwise might have done, in the general cultivation of their faculties, or even, in some cases, from making any such attempt at all. Some poets, of the humbler class, at any rate, might probably be mentioned, who would have written better, if they had taken more pains to add other acquirements to their talent for versifying.

There was in England in the seventeenth century, a famous popular writer, named JOHN TAYLOR, but who was generally called the Water Poet, from the occupation by which he won his livelihood, which was that of a waterman. Taylor, whose parents were poor people, had learned a very little Latin at a school in the city of Gloucester, where he was born; but this, which was in truth merely a few pages of the rudiments, very imperfectly conned, he soon forgot, and he never attempted to recover it. Yet he showed considerable industry in tagging rhymes, both while engaged in the laborious employment we have mentioned, and at an after period, when he kept a victualling-house at Oxford. During the civil wars, he published a great many effusions, on the royalist side of the question, some of which show considerable powers of humor, and give ground for believing that, with more study and a larger acquaintance with literature, the author would have produced excellent compositions.

The mention of Taylor, reminds us of another water-poet, ANTONIO BIANCHI, a common Venetian gondolier, whose epic, entitled 'David, King of Israel,' in twelve cantos, made its appearance at Venice, about the middle of the last century. From the accounts, however, given of this poem, which is written in the Venetian dialect, it appears to be, notwithstanding the provincial and un-

classical character of the language, a work of a very superior order to any thing that the English waterman ever produced, both in genius and in the evidence which it affords of the author's reading and information. Bianchi afterwards published a critical tract, which was deemed to display considerable ability. But an acquaintance even with the most classic poetical productions of their country, is, or was, far from uncommon among the Venetian gondoliers. The writer of the notes to the fourth canto of 'Childe Harold's Pilgrimage' tells us, that many portions of Tasso's 'Jerusalem' used to be familiar to most of them, and that editions of the entire poem, translated into the Venetian dialect, were formerly in general circulation. On one occasion, in January, 1817, he mentions that he, himself, accompanied by Lord Byron, and another Englishman, went to an island, a short way from the city, in a boat rowed by two men, one of whom was a carpenter, and the other a gondolier, the former of whom placed himself at the prow, the latter at the stern. "A little after leaving the quay of the Piazzetta," continues the writer, "they began to sing, and continued their exercise until we arrived at the island. They gave us, among other essays, the death of Clorinda, and the palace of Armida; and did not sing the Venetian, but the Tuscan, verses. The carpenter, however, who was the cleverer of the two, and was frequently obliged to prompt his companion, told us that he could *translate* the original. He added, that he could sing almost three hundred stanzas, but had not spirits to learn any more, or to sing what he already knew: a man must have idle time on his hands to acquire, or to repeat, and, said the poor fellow, 'look at my clothes, and at me; I am starving.'" Bianchi, we ought to add, was also the author of a second poem, of considerable extent, entitled 'Solomon, or the Temple,' as well as of several minor productions.

In Great Britain, there have been many writers of verse who have arisen among the ranks of the laboring population, but, with the exception of Burns, no great poet. Perhaps the name that should be placed next to that of Burns, is that of his countryman, ALLAN RAMSAY, the

author of the Gentle Shepherd, certainly one of the most natural, if not most poetical, pastorals to be found in any language. Ramsay was the son of one of the common workmen, in the lead-mines belonging to the Earl of Hopetoun, in the south of Scotland; and, as soon as his strength permitted, he was himself employed in the mines, as a washer of ore. What education he had, he must have obtained at the village school, and it probably extended little beyond the elements of reading and writing. Having come to Edinburgh, about the year 1700, when he was fifteen years of age, he entered upon his apprenticeship, to a barber; and this profession he afterwards exercised, in that city, for many years. Like John Folcz, of Nuremberg, who was mentioned in our former volume,* and the still more famous Burchiello, of Florence, whose sonnets, written in the fifteenth century, are still admired in Italy, for the purity of their style, Ramsay did not find the business he had chosen so unfavorable, as might be supposed, to intellectual cultivation. During the day, he had abundant opportunities for thought, in his sedentary occupation of making wigs; and he used to spend the leisure of his evenings, in composing songs, and other short poetical pieces, in his native dialect, with no higher aim, at first, than that of adding to the entertainment of the social parties, in which he was wont occasionally to mix. These compositions, however, were often written with so much spirit, that, in a short time, they brought the author into general notice, and, humble as his condition was, he began to be sought after by the most distinguished wits of the northern capital. The connexions which he thus formed, enabled him, at length, to escape from his original trade; and he commenced business, in the more appropriate vocation of a bookseller.

After this, Ramsay wrote and edited various works, and took his rank, in all respects, as one of the literary characters of the day. He lived till the year 1758, when he died, at the age of seventy-three. The fancy of this poet is not very brilliant, but he had the art of writing his native Doric, mellifluously, and his humor, though

* Vol. i. p. 49.

sometimes coarse, has a genial vigor about it which is very effective. In many of his effusions, too, and especially in his principal work, 'The Gentle Shepherd,' there is a natural simplicity and faithfulness of delineation, which all hearts, even the least poetical, are sure to feel and appreciate. These qualities, accordingly, have secured to him a popularity, which, instead of having suffered diminution with the lapse of years, is probably greater, now, than it was in his lifetime; for his writings, it is likely, were then scarcely, if at all, known out of Scotland, whereas his Pastoral is now familiar, by reputation, at least, to many English readers. As the immediate predecessor of Fergusson and Burns, Ramsay has every claim to be considered the father of modern Scottish poetry.

One of the most respectable names, among the humbly-born and self-educated poets of the southern part of the island, is that of the late ROBERT BLOOMFIELD, the author of the 'Farmer's Boy.' Bloomfield was born in 1766, at a small village in Suffolk. His father, who was a tailor, died before the infant was a year old, leaving his widow with the charge of five other children, besides Robert. In these circumstances, in order to obtain a maintenance, for herself and her family, she opened a school, and, of course, taught her own children the elements of reading, along with those of her neighbors. The only school education, which Robert ever received, in addition to what his mother gave him, was two or three months' instruction in writing, at a school in the town of Ixworth. At the time when he was sent to this seminary, he was in his seventh year; and he was taken away so soon, in consequence of his mother marrying a second husband, who probably did not choose to be at any expense in educating the offspring of his predecessor, especially as his wife, in due time, brought him a family of his own.

We have no account of how the boy spent his time, from his seventh to his eleventh year; but at this age, he was taken into the service of a brother of his mother, a Mr. Austin, who was a respectable farmer on the lands of the Duke of Grafton. His uncle treated him

exactly as he did his other servants, but that was kindly, and just as he treated his own sons. Robert, like all the rest of the household, labored as hard as he was able; but, on the other hand, he was comfortably fed and lodged, although his board seems to have been all he received for his work. His mother undertook to provide him with the few clothes he needed; "and this," says Mr. Capel Lofft, "was more than she well knew how to do." Indeed, she found so much difficulty in fulfilling her engagement, that she at length wrote to two of her eldest sons, who were employed, in London, as shoemakers, requesting them to assist her, by trying to do something for their brother, who "was so small of his age," she added, "that Mr. Austin said, he was not likely to be able to get his living by hard labor." To this application, her son George wrote, in reply, that if she would let Robert come to town, he would teach him to make shoes, and his other brother, Nat, would clothe him. The anxious and affectionate mother of the future poet assented to this proposal; but she could not be satisfied, without accompanying her son to the metropolis, and putting him herself into his brother's hands. "She charged me," writes Mr. George Bloomfield, in giving an account of the incident, "as I valued a mother's blessing, to watch over him, to set good examples for him, and never to forget that he had lost his father."

When Bloomfield came to London, he was in his fifteenth year. What acquaintance he had with books, at this time, is not stated, but it must have been extremely scanty. We find no notice, indeed, of his having been in the habit of reading any at all, while he was with Mr. Austin. Yet it would appear, from the sequel of his brother's account, that he had at least contrived to retain so much of what he had learned in his younger days, as still to be able to read tolerably. The place, in which the boy was received, by his two brothers, was a garret in a court in Bell Alley, Coleman Street, where they had two turn-up beds, and five of them worked together. "As we were all single men," says George, "lodgers at a shilling per week, each, our beds were coarse, and all

things far from being clean and snug, like what Robert had left at Sapiston. Robert was our man to fetch all things to hand. At noon, he fetched our dinners from the cook's shop; and any one of our fellow-workmen, that wanted to have any thing fetched in, would send him, and assist in his work, and teach him, as a recompense for his trouble. Every day, when the boy from the public-house came for the pewter pots, and to hear what porter was wanted, he always brought the yesterday's newspaper. The reading of the paper we had been used to take, by turns; but, after Robert came, he mostly read for us, because his time was of least value."

The writer goes on to state, that, in this his occupation, of reader of the newspapers, Robert frequently met with words which were new to him and which he did not understand, a circumstance of which he often complained. So one day, his brother, happening to see on a book-stall, a small English dictionary, which had been very ill used, bought it for him, for fourpence. This volume was, to Robert, a valuable treasure; and, by consulting and studying it, he soon learned to comprehend perfectly, whatever he read. The pronunciation of some of the hard words, however, still puzzled him a good deal; but by a fortunate accident, he was at length put in the way of having his difficulties here, also, considerably diminished. One Sunday evening, after a whole day's stroll in the country, he and his brother chanced to walk into a dissenting meeting-house, in the Old Jewry, where a preacher of extraordinary abilities and great popularity was delivering a discourse. This was Mr. Fawcet, whose sermons, which have been printed, are very powerful compositions. Fawcet's manner was highly rhetorical, and "his language," says Mr. George Bloomfield, "was just such as the *Rambler* is written in." Robert was so much struck by his oratory, that, from this time, he made a point of regularly attending the chapel, every Sunday evening. In addition to the higher improvement of Mr. Fawcet's discourses, he learnt from him the proper accentuation of difficult words; which he had little chance of hearing pronounced elsewhere. He also accom-

panied his brother, sometimes, but not often, to a debating society, which was held at Coachmaker's Hall, and a few times to Covent Garden theatre. Besides the newspapers, too, he at this time read aloud to his brothers and their fellow-workmen several books of considerable extent—a History of England, British Traveller, and a Geography, a sixpenny number of each of which, in folio, they took in every week. But these "he always read," says his brother, "as a task, or to oblige us who bought them." He calculates that Robert spent in this way, about as many hours, every week, in reading, as boys generally do in play.

These studies, however, although somewhat reluctantly applied to, doubtless had considerable effect in augmenting the boy's knowledge, and otherwise enlarging his mind. But it was a work of a different description from any of those that have been mentioned, which may be said to have first awakened his literary genius. "I at that time," continues Mr. George Bloomfield, "read the London Magazine; and, in that work, about two sheets were set apart for a Review. Robert seemed always eager to read this Review. Here he could see what the literary men were doing, and learn how to judge of the merits of the works that came out. And I observed that he always looked at the 'poet's corner.' And one day, he repeated a song, which he composed to an old tune. I was much surprised that he should make so smooth verses; so I persuaded him to try whether the editor of our paper would give them a place in the poet's corner. He succeeded, and they were printed." This is the way in which many a young literary aspirant has first tried his strength. Thus, as we noticed in our former volume, the Ladies' Diary was the repository of Thomas Simpson's earliest mathematical speculations; and it was in the columns of a small Boston newspaper that Franklin commenced his career as an author. A Bristol journal, in like manner, received the earliest antiquarian lucubrations of Chatterton, then only a boy of fifteen, while much about the same time the first of his Rowleian forgeries appeared in the 'Town and Country Magazine.'

After this, Bloomfield contributed other pieces to the same publication into which his first verses had been admitted; and under the impulse of its newly-kindled ambition, his mind would appear to have suddenly made a start forwards, which could not escape the observation of his associates. "Indeed, at this time," says his brother, "myself and fellow-workmen in the garret began to get instructions from him." Shortly after, upon removing to other lodgings, they found themselves in the same apartment with a singular character, a person named James Kay, a native of Dundee. "He was a middle-aged man," says Mr. George Bloomfield, "of a good understanding. He had many books, and some which he did not value; such as the 'Seasons,' 'Paradise Lost,' and some novels. These books, he lent to Robert, who spent all his leisure hours in reading the 'Seasons,' which he was now capable of reading. I never heard him give so much praise to any book as to that."

It was the reading of the 'Seasons,' in all probability, which first inspired him with the thought of composing a long poem on rural subjects. The design was also in some degree favored, by a visit of two months, which he was induced to pay, about this time, to his native district, in order to escape from the annoyance with which he was threatened, owing to a dispute that had taken place in the trade to which he belonged, between those workmen who had, and those who had not, served a regular apprenticeship. As Bloomfield belonged to the latter class, the others, who had formed themselves into an association, talked of prosecuting his master for employing him; and he begged to be suffered to retire, till the storm should blow over. On this occasion, his old master, Mr. Austin, kindly invited him to make his house, his home; and the opportunity he thus had of reviewing, with a more informed eye, the scenes in which he had spent his early years, could hardly fail to act with a powerful effect in exciting his imagination. It was at last arranged, that he should be taken as apprentice, by his brother's landlord, who was a freeman of the city; and he returned to town. He was, at this time, eighteen

years of age. It was not intended, that his master should ever avail himself of the power which the indentures gave him, and he behaved in regard to this matter very honorably. George, therefore, remained with his brother for about two years longer, by which time, he had taught him to work as expertly as himself.

For some years after this, Robert's literary performances seem to have amounted merely to a few effusions, in verse, which he used generally to transmit in letters to his brother, who had now gone to live at Bury St. Edmunds, in his native county. Meantime, he studied music, and became a good player on the violin. In his twenty-fifth year, he married, when "he told me in a letter," says his brother, "that he had sold his fiddle, and got a wife. Like most poor men, he got a wife first, and had to get household stuff afterward. It took him some time to get out of ready-furnished lodgings. At length, by hard working, &c., he acquired a bed of his own, and hired the room up one pair of stairs, at 14, Bell Alley, Coleman Street. The landlord kindly gave him leave to sit and work in the light garret, two pair of stairs higher."

The frequency of the developement of literary talent among shoemakers, has often been remarked. Their occupation, being a sedentary and comparatively noiseless one, may be considered as more favorable, than some others, to meditation; but, perhaps, its literary productiveness has arisen quite as much from the circumstance of its being a trade of light labor, and therefore resorted to, in preference to most others, by persons in humble life, who are conscious of more mental talent than bodily strength. Partly for a similar reason, literary tailors have been numerous. We have mentioned, in our former volume, the Italian writer, Gelli, the learned Hill, and Wild, &c.; and to these, we might add many others, as, for example, George Ballard, author of 'Memoirs of Learned British Ladies,' and who made himself a good Saxon scholar, while practising his trade,—the antiquaries, Stow and Speed, who both flourished in the sixteenth century, the former the author of 'The Survey of

London,' and other very elaborate works, and the latter, of a valuable 'History of Great Britain,'—and the celebrated mathematician, Jean Henri Lambert, who, when young, after working all day with his father, who was a tailor, used often to spend the greater part of the night in reading, and in this manner, by the assistance of an old work which came by chance into his possession, instructed himself in the elements of mathematical science.

Of literary shoemakers again, or persons who have contrived to make considerable progress in book-learning, while exercising that handicraft, we have already noticed, among others, Benedict Baudouin, Anthony Purver, Joseph Pendrell, Gifford, and Holcroft. We may add to the list, that extraordinary character Jacob Behmen, the German mystic, of whose works we have an English translation, in two volumes quarto, and who continued a shoemaker all his life. But Bloomfield, before entering upon the exercise of this trade, had had the education of his faculties begun, while following the equally contemplative, and much more poetical, occupation of a keeper of sheep—a condition, the leisure and rural enjoyment of which, had fed the early genius of the painter Giotto, the logician Ramus, the mechanician Ferguson, the linguist Murray, and many others of the lights of modern literature and art, as in the ancient world, it is said to have done that of the poet Hesiod. Bloomfield's literary acquirements, however, with the exception of his acquaintance with the mere elements of reading and writing, appear to have been all made, during the time he was learning the business of a shoemaker, and afterwards while he worked at the same business as a journeyman.

It was while he sat plying his trade in his garret in Bell Alley, with six or seven other workmen around him, that Bloomfield composed the work which first made his talents generally known, and for which, principally, he continues to be remembered, his 'Farmer's Boy.' It is a curious fact, that, notwithstanding the many elements of disturbance and interruption, in the midst of which the author must in such a situation have had to proceed through his task, nearly the half of this poem was com-

pleted, before he committed a line of it to paper. This is an instance of no common powers, both of memory and of self-abstraction. But these faculties will generally exist in considerable strength, when the mind feels a strong interest in its employment. They are faculties, also, which practice is of great use in strengthening. Bloomfield's feat, on this occasion, appears to have amounted to the composing and recollecting of nearly six hundred lines, without the aid of any record; and the production of all this poetry, in the circumstances that have been mentioned, perhaps deserves to be accounted a still more wonderful achievement than its retention. Like his prototype, Thomson, whose general scheme he also followed, Bloomfield seems to have commenced his poem, with the division relating to Winter.

When the 'Farmer's Boy' was finished, which it appears to have been in April, 1798, it was submitted to several booksellers and other persons in London, none of whom, however, probably took the trouble of even examining the unrecommended production. At last, in November, of the same year, it was forwarded by Mr. George Bloom field to the late Mr. Capel Lofft, who then resided on his estate in the immediate neighborhood of the poet's birthplace. The poem was accompanied by a letter containing the narrative of the author's life, from which we have extracted the particulars given above. Induced to look into the manuscript, probably, in part, by the circumstance of its being the production of a native of Suffolk, Mr. Lofft soon found the work to be well deserving of attention on its own account. He immediately entered into a correspondence with the author; and the result was the publication of the poem, after a few provincialisms and grammatical errors, by which it was disfigured, had been corrected, in the month of March, 1800. It immediately produced a considerable sensation; and although a portion of the interest which was felt in regard to it, is doubtless to be attributed to the extraordinary circumstances in which it was announced to have been written, it yet owed much of its popularity, also to its intrinsic merits. Within the first three years after its

appearance, seven editions, comprising in all, twenty-six thousand copies, had been printed; and new impressions have since been repeatedly called for. It was early translated into French and Italian, and part of it even into Latin, which last circumstance drew from the poet a few verses printed among his minor productions.

The publication of the 'Farmer's Boy,' at once called forth the author, from obscurity, to a fair prospect both of fame, and, what to him must have been hitherto unhoped for, fortune. The change, which had taken place in his condition and expectations, is well and graphically described in the simple language of his brother, whose exertions in his behalf, had so large a share in bringing about what had now taken place. "I have him," he writes to Mr. Lofft, in reference to Robert's first appearance in London, "in my mind's eye, a little boy; not bigger than boys generally are at twelve years old. When I met him and his mother at the inn, he strutted before us, dressed just as he came from keeping sheep, hogs, &c.—his shoes filled full of stumps in the heels. He, looking about him, slipped up: his nails were unused to a flat pavement. I remember viewing him as he scampered up;—how small he was. I little thought that diminutive fatherless boy, would be one day known and esteemed by the most learned, the most respected, the wisest, and the best men of the kingdom." It is gratifying to know, that those excellent and affectionate relations, his mother and brother, both lived to witness the prosperity of him, who, in other days, had been to each the object of so much anxious care. It was the dearest of the poet's gratifications, when his book was printed, to present a copy of it to his mother, to whom, upon that occasion, he had it in his power, for the first time, to pay a visit, after twelve years absence from his native village.

Bloomfield published several volumes of poetry, after the 'Farmer's Boy;'—among others, a small volume, entitled, 'Rural Tales, Ballads, and Songs,' which were written, he tells us, during the interval between the completion of the composition of his first work, and its

appearance in a printed form. Soon after this, however, his health, which had never been very vigorous, began to give way; and he was obliged to resign an appointment in the Seal Office, which had been given to him by the Duke of Grafton, and on receiving which, he had relinquished his original trade. He now found his musical turn a resource; and realized a small income, by manufacturing Æolian harps. But his health gradually grew so much worse, that he was at last obliged to leave London, altogether, upon which he retired to Shefford, in Bedfordshire. Here he remained, till his death, on the 19th of August, 1823, in the fifty-eighth year of his age.

Although he was an extraordinary instance of what the force of native talent will sometimes accomplish, where education has been nearly altogether withheld, yet Bloomfield gave plentiful evidence, especially in his first production, of the disadvantages under which he labored, from the want of early cultivation. A better education, in his youth, would have saved his homely genius from being misled into affectations uncongenial to its true spirit; and his want of a competent director in his studies, exposed his taste to be corrupted by bad examples. It is probably, indeed, a mistake, to suppose that the circumstance of an individual having been what is called self-taught, is generally favorable to the originality of his literary productions. There is more reason for suspecting, that even those self-taught writers who have displayed most of this highest element of power, would have exhibited it in still greater abundance, if they had enjoyed, in addition to their rare gifts of Nature, the advantages of a regular education. It is certain, at any rate, that the literary performances of men who have been their own teachers, have not, except in a few extraordinary cases, been, in any degree, peculiarly distinguished by this quality.

Of the numerous tribe of self-taught verse-makers, especially, the great majority have been the merest imitators. A fair specimen of this race, the individuals of which, although they sometimes excite a temporary attention, generally drop very speedily into oblivion, we have,

in a writer, named STEPHEN DUCK, who flourished in the early part of the last century. Duck was born about the year 1700, at the village of Charlton, in Wiltshire, England. He was at school, for a short time, in his boyhood, when he learned a little reading, writing, and arithmetic. When about fourteen, however, he was sent to work, as an agricultural laborer; and being employed for several years in the lowest rural occupations, without ever opening a book, he soon forgot what little learning he had ever possessed. Still, as he used afterwards to tell, even at this time, his thoughts were often engaged on subjects very foreign to his daily employments. At last, he began to read a little, and this gradually inspired him with a desire to recover his lost knowledge, scanty as it had been. At this time, he was about twenty-four years of age, with a wife and family to support; and being engaged in hard work, all day, he had but very little time for study. He was also without books, and had no money to buy any. Yet such was his ardor to obtain the means of instructing himself, that, for some time, whenever he had an hour's release from his regular employment, he devoted it to extra work; and in this way, he saved money enough to purchase, first, a treatise on vulgar fractions, then one on decimal fractions, and lastly, one on land surveying. All these works he made himself master of, by studying them during the night, when everybody about him was asleep.

Soon after this, he became intimately acquainted with a person, in the same condition of life as himself, but who had passed some years in service in London, whence he had brought down a few dozens of books with him, to the country. Of these, some were treatises on arithmetic; among the others, were, the Bible, Paradise Lost, the Spectator, Seneca's Morals, Telemachus, an English Dictionary and Grammar, Ovid, Josephus, seven plays by Shakspeare, and a few more by other writers; Dryden's Virgil, Hudibras, and the works of Waller and Prior. Duck had, it seems, been always fond of poetry and music; though hitherto, the best specimens of either, which he had had an opportunity of enjoying, had been

only a few rustic ballads. But his perusal of some of the above works, inspired him with new enthusiasm, and, in no long time, he began to attempt writing verses himself. The first poetical work, by which he was greatly struck, was Paradise Lost. Yet he read it through twice or thrice, with the aid of his dictionary, before he understood it. The new beauties he was continually discovering, however, made all this labor delightful. He studied the book, we are told, as a student of Greek or Latin would do one of the ancient classics, and making all the while as much use of his dictionary and grammar as if it had been written in a foreign language. These literary labors were still generally pursued during the night. Sometimes, however, he used to take a book with him, in his pocket, when he went out to his daily work, in the fields; and if, by working with more activity than customary, he could get through what he had to do, in less than the usual time, he would devote the few precious moments he had gained, to the perusal of his book.

Even while at work, he often employed himself in composing verses. It was some time, before he thought of committing any of his compositions to paper; but at last, he was induced to address a letter in verse, to a gentleman, who, having heard of his acquirements, had sought him out, and made his acquaintance; and this effusion having been shown to several other persons, was generally regarded as a very surprising performance, for one in his circumstances. Some clergymen, in particular, to whom it was submitted, were so much pleased with it, that they rewarded the author with a small gratuity. From this time, his talents began to be generally talked of; and, encouraged by the praise he received, he did not suffer his poetical faculty to lie dormant. The consequence was, that, in a short time, he had accumulated a respectable store of verse. It seems to have been not long before the year 1730, that Duck attracted the notice of the Rev. Mr. Spence, already mentioned as the patron of Robert Hill, the learned tailor, and the blind poet, Blacklock. Spence, who did himself great credit, by the interest he took in these cases of indigent merit, immediately

conceived the idea of bringing the claims of his protégé before the public, in the most effective manner, through the press; and, accordingly, as many of his poems were collected, as formed a quarto volume, which made its appearance in that year. Besides the general reputation which the author acquired, by this publication, it procured for him the particular favor and patronage of Queen Caroline, who immediately settled upon him a pension of thirty pounds a-year. In 1733, he was made one of the Yeomen of the Guard. He now applied himself to the study of the Latin language; in which having made some progress, he was admitted into holy orders. On this, the queen appointed him, in the first instance, keeper of her library at Richmond, and in a short time after, he was preferred to the living of Byfleet, in Surrey. Meanwhile, a second edition of his poems had appeared in 1736, to which we find the names of the queen and other members of the royal family prefixed as subscribers. Duck became much beloved and respected by the people of Byfleet, in his capacity of pastor, and lived there happily for many years. But the termination of his history is very melancholy. He at last fell into low spirits, and drowned himself, in the Thames, near Reading, in the year 1756. His poems have now long been forgotten. They had little merit, except considerable smoothness of versification, which, even in those days, the example of Pope had rendered a common quality.

CHAPTER IX.

H. K. White; Hawkesworth; Goldsmith; Mendelsohn.

In selecting our examples from the class at present under review, of those, who, in the midst of unfavorable circumstances, have distinguished themselves by their ardor in the pursuit of knowledge, there is one name, not

to be omitted,—that of the late gifted and amiable HENRY KIRKE WHITE. As it is probable, however, that most of our readers are acquainted with the narrative of his life, which has been so delightfully written by Mr. Southey, we shall confine ourselves to a short notice of its leading incidents. He was born, in 1785, at Nottingham, England, where his father followed the business of a butcher. He was sent to school, at three years of age, and soon became so fond of reading, that, when he had got his book in his hand, it was difficult to get him even to leave it for a few minutes, that he might take his meals. When no more than seven, he began to attempt to express his ideas on paper; his first composition being a tale, which, ashamed to show it to any one else, he communicated to the servant, to whom he had for some time been secretly giving instructions in writing. His school acquisitions, before the age of eleven, in addition to reading and writing, were arithmetic and French; in both of which studies, he had already distinguished himself above all his schoolfellows. Soon after this, he also began to write verse.

His father, however, who was anxious to bring him up to his own business, although very much against both his own wish and that of his mother, now insisted that he should be employed one whole day in the week, and during his leisure hours, on others, in carrying the butcher's basket. But he expressed so much dislike to this occupation, that it was at last arranged, that he should be sent to learn the hosiery trade; and at the age of fourteen, accordingly, he began to work as a stocking-weaver. To a heart like his, full of the love of literature, and all whose young visions were already those of a student, this destination was a very cheerless one. Yet he hardly dared to complain, for he knew that his family could scarcely afford to educate him to any higher employment. His mother, however, moved by his evident wretchedness, contrived, after he had been about a year at the loom, to prevail upon his father to allow him to be placed in the office of Messrs. Coldham and Enfield, attorneys in Nottingham, who agreed to take him without a premium, on condition of his serving two years, before being articled.

He now felt himself in something like his proper sphere, and his whole mind assumed new alacrity. Although nearly the whole day was necessarily given to the study of his profession, for he attended in the office, as he informs us, himself, in one of his letters, from eight in the morning till eight at night, he still found time to apply himself to the Greek and Latin languages; in the latter of which, with very little assistance, he enabled himself, in ten months, to read Horace with tolerable ease. This progress, however, was obtained at the cost of almost incessant application. He read, during his walks, and at his meals; and not a moment, indeed, of his leisure was given to anything except the improvement of his mind. In this manner, it was surprising how much he accomplished. The papers he left behind him, showed, Mr. Southey tells us, that he had applied himself to his legal studies, with extraordinary industry. Besides the knowledge which he acquired of Greek and Latin, he also made considerable progress, at this time, in Italian, Spanish, and Portuguese. Chemistry, electricity, astronomy, all shared largely in his attention. While pursuing these severer studies, he contrived to accomplish himself, to a considerable extent, in drawing and music; and he found an occasional amusement in practical mechanics, in which he showed much ingenuity and neatness of hand. Another accomplishment, which he wished to acquire, was the art of extemporary speaking; and with this view, he got himself elected a member of a debating society, which then existed at Nottingham. Here he very soon distanced all his competitors.

But this was not the only mode, in which he had already begun to seek distinction. So early as the first year after his emancipation from the stocking-loom, he had sent a translation from Horace, to a periodical work then existing, called the 'Monthly Preceptor,' the proprietors of which were in the habit of offering prizes, for the best contributions, on subjects which they proposed; and a silver medal had been awarded to him, for his performance. This honor, seems to have kindled his literary ambition to greater fervor than ever. He began to sigh for the advantages of a University education. After

having thus frequently tried his powers in the 'Preceptor,' he became a correspondent to another magazine, called the 'Monthly Mirror.' Some of the essays which he sent to this publication, were of distinguished merit, and attracted considerable notice. Among other persons, whose attention they excited, was Mr. Capel Lofft, whose patronage of Bloomfield we recorded a few pages back; and the encouragement of this gentleman, whose exertions had recently been so fortunate in the case of another poet, determined Henry to commit a volume of his verses to the press. This was about the close of the year 1802.

The volume made its appearance, in the end of 1803, or beginning of 1804. It was published by subscription, and dedicated, by permission, to the Duchess of Devonshire. What pecuniary return it brought the author, is not stated; but the sale probably did not do a great deal more than defray the expenses of the publication. Although favorably noticed, in several of the periodical works of the day, it was made the subject of a very harsh article, in the 'Monthly Review.' This so stung the sensibility of the young poet, that he sent a remonstrance to the editors, which produced from them, in their next number, an expression of their regret, that Mr. White should have been so much hurt by the severity of their criticism; but no acknowledgement was paid of the poetical merit of the publication they had condemned. This treatment distressed Henry exceedingly. In one of his letters, he says, "This Review goes before me, wherever I turn my steps; it haunts me incessantly; and I am persuaded it is an instrument in the hands of Satan, to drive me to distraction. I must leave Nottingham." Fortunately, however, the poems had fallen into the hands of Mr. Southey, who, bringing to their perusal both a better judgement and a kinder heart than the writer in the Monthly Review, considered them "to discover strong marks of genius." On afterwards seeing the Review, this gentleman's indignation was so strongly excited, by what he deemed its cruelty and injustice, that he immediately wrote to Henry a letter of encouragement and advice, with an offer to do anything in his power to for-

ward his views. This generous and seasonable interference, contributed greatly to heal the poet's wounded feelings; and enabled him, in a short time, to forget the sneers of his anonymous critic.

No prospect, however, had yet opened, of his desire of going to the University being gratified; while the desire itself was every day growing stronger. The reading of some religious works, about this time, had made a great impression upon him; and his feelings had become ardently devotional. He determined to give up his life to the preaching of Christianity. His friends exerted themselves, in vain, to shake his resolution; but he had made up his mind, if he could not obtain admission at either of the Universities of Oxford or Cambridge, that he would endeavor to find the means of pursuing his studies at an academy, or at one of the Scottish Universities. But we must refer to Mr. Southey's interesting narrative, for a detail of the alternating hopes and disappointments, by which both his mind and frame were racked, before he at last secured the object of his fond ambition. At one time, he had given up all hopes of ever being able to escape from his present profession; and the view which he took, of the line of conduct, which it became him to pursue, in these circumstances, is in the highest degree creditable to his sense of propriety and duty. "All my hopes," says he, in a letter to his mother, "of getting to the University, are now blasted; in preparing myself for it, I have lost time in my profession; I have much ground to get up, and as I am determined not to be a *mediocre* [second rate] attorney, I must endeavor to recover what I have lost. He immediately set about a course of more severe application than ever, allowing himself rarely more than two or three hours of sleep, during the night, and often never going to bed at all. This excessive application, after some time, brought on an alarming illness, from which his friends thought that he never entirely recovered.

But at last, a sizership,* at St. John's, was procured for him, through the influence of the Rev. Mr. Simeon,

* [A *Sizer*, at Cambridge, or *Servitor*, at Oxford, is a scholar who attends upon other students, for his maintenance.—Am. Ed.]

of King's College, Cambridge, to whom he had been recommended. His mother, who had for some years kept a boarding-school, and his elder brother, engaged each to allow him fifteen or twenty pounds yearly; and Mr. Simeon generously undertook to afford him thirty pounds more, with the aid of a friend, who is stated to have been Mr. Wilberforce, a name made venerable by a life spent in doing good. Accordingly, in October, 1804, he quitted his employers at Nottingham, who had most kindly agreed to give him up the remainder of his time, although his services were every day becoming more valuable to them. He did not, however, immediately proceed to Cambridge, but, by Mr. Simeon's advice, placed himself, for the first year, in the house of the Rev. Mr. Grainger, of Winteringham, in Lincolnshire. While residing with this gentleman, he applied himself to classical learning with an ardor to which every thing gave way, devoting often fourteen hours a-day to hard study; and though his unremitting toils soon laid him once more on a sick-bed, convalescence came only to send him back to his books, with as much zeal as ever. When he went to Cambridge, to use Mr. Southey's words, "the seeds of death were in him, and the place to which he had so long looked on with hope, served unhappily as a hothouse to ripen them."

The exertions of this extraordinary young man, at the University, were such as might have been expected from his previous career. A scholarship having become vacant during his first term, he was advised to offer himself as a competitor for it; but after having studied for this purpose, with his usual immoderate application, till within a fortnight of the close of the term, he found himself so ill, that he was obliged to decline coming forward. To add to his misfortune, he had now the general college examination before him; and, although far from well, he was urged, if it was at all possible, to persevere in preparing himself for this occasion. He followed this counsel, and having, by the aid of strong medicines, been enabled to hold out during the six days of the examination, he was, at its close, declared the first man of his year. Im-

mediately after this, he went to London, with the view of benefiting his health by a temporary relaxation from study. But he did not make much progress in recovering his strength, during this short excursion. Still, when he returned to Cambridge, his application continued unabated. It is mentioned, as an instance of the manner in which he used to turn every moment to account—in his own phrase, to *coin* time—that he committed to memory a whole tragedy of Euripides, during his walks. At the end of this term, he was again pronounced first man, and also one of the three best theme-writers. By exhibitions, too, which were procured for him, he was now enabled to live without the assistance of his friends. At the end of the term, a tutor in mathematics, for the long vacation, was provided for him by his college; but this, unfortunately, only induced him to continue his studies, at a time when relaxation was become absolutely necessary to preserve his life. Finding himself very ill, he again proceeded to London; where, however, as before, he got no better. He returned to the University, worn out both in body and in mind, and, after a short attack of delirium, died on Sunday, the 19th of October, 1806.

A monument has been erected to the memory of Kirke White, in the Church of All Saints, Cambridge, at the expense of Dr. Boott, a native of the United States.* This gentleman, on visiting Cambridge, was disappointed in finding no tablet recording the talents and virtues of the young poet; and he resolved to do what England had left undone. This circumstance is highly creditable to the American character; and is one, amongst many evidences, of the triumph of right feelings over those mutual jealousies which have too often separated nations sharing the same blood, and speaking the same language.

We shall conclude this chapter, by the mention of one or two other individuals, from the list of the cultivators

* [Francis Boott, M. D., formerly of Boston, but for some years past a resident at Liverpool, a gentleman of high reputation in his profession, greatly endeared to many of his countrymen, by his politeness and attention to them, while in a foreign land, and universally respected wherever known.—Am. Pub.]

of elegant literature, whose rise to eminence has been in like manner impeded for a time by an untoward fortune. Dr. HAWKESWORTH, one of the most popular writers of the last century, and whose periodical work, the 'Adventurer,' entitles him to a high place among English essayists, was originally a watchmaker, and afterwards became clerk to a writing stationer, in which situation it was that he commenced his career as an author, by some communications which he sent to the 'Gentleman's Magazine.' From this beginning, he made his way, by the persevering exertion of his talents, both to distinction and to considerable wealth. Hawkesworth must have been indebted for his literary acquirements, almost entirely to himself.

Together with his name, may be quoted that of his much more distinguished contemporary, Dr. GOLDSMITH, who was however more regularly educated. Goldsmith was one of nine children, of a very-poorly-endowed clergyman of the Church of Ireland, in which country he was born, in the year 1728. Of academical instruction he had his full share; for he attended successively the Universities of Dublin, Edinburgh, and Leyden. At the last two mentioned places, he studied medicine, which he had chosen as his profession, after having been originally intended for trade, and then successively for the Church and the law. His eccentric, imprudent, and reckless habits, however, which had been constantly involving him in one difficulty or other from his boyhood, acquired strength with his years; and he had not been long at Leyden when he found himself reduced, by his thoughtlessness and extravagance, to a state of destitution, as bad as that which a short time before, had forced him to take flight from Edinburgh. On this, he left the University, and set out to travel over the continent, possessed of nothing in the world but the clothes he wore and his flute. It was on the latter, he depended for his support, his practice being, when, after walking all day, he arrived at a village in the evening, to assemble the inhabitants around him, to dance to his music, in return for which they generally gave him lodgings for the night, and where-

withal to procure him food for the next day. In this manner, he walked over a great part of Flanders, the south of France, Germany, Switzerland, and Italy. At last, he arrived in London, with, it is said, only a few pence in his pocket. In this emergency, he was fortunate enough to meet with his countryman and college acquaintance, Dr. Sleigh, who had been one of Barry's first patrons, when he came up to Dublin; and by the aid of this gentleman, he obtained the situation of assistant teacher in a school at Peckham. Soon afterwards, he offered his services to an apothecary in the metropolis, and with him he lived for some time. It was while in this situation, that he first turned his thoughts to literary labor, as a means of support. He began by writing for the 'Monthly Review' and the 'Public Ledger,' to which last he contributed the series of essays, in the form of letters from a Chinese residing in England, to his friends in China, which were afterwards collected and published, under the title of the 'Citizen of the World.' He had been employed, in this manner, for several years, gaining only a scanty and precarious livelihood, when, in 1765, he published his celebrated poem, 'The Traveller.' This immediately brought him into notice, and placed him among the first writers of the day. He had now better employment, and as much as he could undertake; but, his improvidence continuing as great as before, his difficulties were not much diminished. The very year following that in which 'The Traveller' appeared, Dr. Johnson found him unable to leave his lodgings, in consequence of a debt he had contracted, and to pay which, his kind friend disposed of the manuscript of his 'Vicar of Wakefield.' That exquisitely beautiful tale, accordingly appeared in 1766; and soon after, was published his 'History of England,' in a series of letters from a nobleman to his son, which immediately excited great attention and became extremely popular.

From this time, till his death, Goldsmith gave to the world a succession of works, which prove, that with all his faults, a want of industry cannot be laid to his charge. His comedy of the 'Good-natured Man,' a 'History of

Rome,' and another 'History of England,' in four volumes, the poem of the 'Deserted Village,' the comedy of 'She Stoops to Conquer,' a 'History of Greece,' and his four volumes, entitled, a 'History of Animated Nature,' besides abridgements of his different historical works, and numerous minor pieces, in prose and verse, all proceeded from his pen between the years 1768 and 1774, in the latter of which, he died, at the early age of forty-six. Nor are even those of the works we have enumerated, which partake most of the character of mere compilations, unmarked by many traces of the author's genius.

Goldsmith, as Johnson has said of him on his monument in Westminster Abbey, touched no subject which he did not adorn. The purity and elegance of his style, and the chastity, in all respects, of his manner as a writer, form a remarkable contrast to what we are told of his general conduct and demeanor. The dissimilarity, is said to have been equally great between the wit, spirit, and good sense of his literary productions, and the eccentricity of his conversation, which is described as sometimes approaching to childishness. But Goldsmith was an extraordinary instance how perfect the reflective or meditative powers of the mind will sometimes be, while those which fit a man for the business of active life, are weak or wanting. A mere child, as he seemed when called upon to exert the latter, in the ease with which he wielded the former he had few equals, and no superior. As his friend, Johnson, used to say of him, with his pen in his hand, he was a sage, without it a fool.

Most of Goldsmith's follies, however, were the results of a simplicity and good nature, which did no dishonor to his heart, however they may have impeded his advancement in the world. From the time he rose into notice, as a writer, till his death, he was the prey of his poorer brethren of the quill, who, when he had received any money for his works, borrowed or begged from him his last sixpence. Nay, he was often wont, it is said, to borrow money, in order to satisfy these plunderers. The consequence was, that he was always in difficulties, which

he certainly needed not to have been, if he could have taken better care of his gains; for he was both one of the most successful, and, as we have seen, one of the most industrious, literary laborers of the day. Considering, indeed, the idle and wandering life he had so long led, Goldsmith's comparatively steady application in the latter years of his life, as testified by what he actually accomplished, deserves to be accounted not a little remarkable. It is probable, however, from the knowledge and general cultivation of mind which he displayed even in his first literary works, that he must long have been a more diligent student, than we should be inclined to think, from the general sketch that has been handed down to us of his early history.

At the same period with Goldsmith, flourished the celebrated MOSES MENDELSOHN. Mendelsohn was born at Dessau, the capital of the small principality of Anhalt, in 1729, the same year which gave birth to Heyne and Lessing. The copies of the Pentateuch which are used in the Jewish Synagogues are, as is well known, all in manuscript; and to transcribe these, was the chief occupation of Mendelsohn's father. He also kept a day-school for the children of his Hebrew brethren. Nevertheless, with all his labors, his gains were extremely scanty; and his son was accustomed, from his earliest years, to poverty and privation.

After being taught the elements of Hebrew scholarship, by his father, Moses was sent, at an early age, to a public seminary, where the other young Jews of the place, who were intended for a learned profession, were educated. The system pursued at this establishment, however, was little calculated to nurture or strengthen the more important mental faculties; the chief, or rather almost the only, exercise of the pupils, being, to get by heart portions of the rabbinical commentaries which they could not understand. It is said, that, when no more than seven years old, Mendelsohn began to discern the absurdity of this method of study, and applied himself, of his own accord, to the obtaining of a correct acquaintance with the grammar of the sacred tongue, as an indispensable preliminary

to his further progress. So early as his tenth year, he had begun to write verses in Hebrew. He was fortunate, soon after this, in obtaining the instructions of David Frankel, a man of profound learning, who was then chief Rabbi at Dessau, and whom the young student greatly attached to himself, by his application and his thirst for knowledge. By Frankel's assistance, and his own industry, the boy soon acquired a knowledge of the Scriptures and their principal commentaries, rare at that time, even among the more learned classes of his nation.

The ardor with which he pursued his studies, at this early age, was too great for a frame which never had been very strong; and it brought on, ere long, a nervous disorder, the consequences of which remained with him during his life. It produced, in particular, a deformity of the spine, which was found to be incurable. The work, which he had been most eagerly engaged in studying, when attacked with this illness, was the *More Nevochim*, or *Guide for the perplexed*, of the great Moses Maimonides, the learned Spanish Jew of the twelfth century; and in allusion to this circumstance, Mendelsohn would long afterwards remark, that it was Maimonides who had spoilt his figure and ruined his constitution. "But still," he would add, "I doat on him for the many hours of delight he has afforded me; and, if he has unwittingly weakened my body, has he not made me ample amends, by invigorating my mind?"

When Mendelsohn was about fourteen years of age, his friend and instructer, Frankel, left Dessau for Berlin, and he was now almost without an associate. It was time, besides, that he should think of doing something, to gain his own subsistence. His father, accordingly, who was tenderly attached to him, and would willingly have kept him longer under his humble roof, was at last prevailed upon, by his earnest entreaties, to permit him to proceed to Berlin, in the hope, that, through Frankel's assistance, he might procure some employment in that large city. The good Rabbi was scarcely able to do anything for him from his own resources; but he recommended him to a benevolent friend, who gave him an attic-room in his house, to

sleep and study in, and allowed him two days' board, every week. The only resource he possessed, for a long time, in addition to this, was a little employment as a transcriber, which Frankel procured for him. With the proceeds of this, he contrived to exist, and to pursue his studies; but his privations were often very great. It was his custom, at this time, as he used afterwards to relate, when he bought a loaf, to notch it into portions that might last him till he counted upon obtaining his next supply of money; and, however hungry, he would never eat more at a meal, than he had thus allowed himself.

It was not, at this period, the practice among the Jews, to study the classic languages; but Mendelsohn, inquisitive after all knowledge, and reading with avidity every accessible work which promised him any information, soon discovered, that, without an acquaintance with Greek and Latin, his literary researches must remain extremely limited. He therefore resolved to acquire these languages. But how he was to take the first step in this pursuit, it was not very easy to understand. The Hebrew and the German were the only languages he knew, and there was no Greek or Latin grammar, as far as he was aware, written in either. In this difficulty, a fortunate chance brought him acquainted with a brother Jew, a person of the name of Kish, from Prague, who was a medical practitioner, and knew something of Latin. Mendelsohn prevailed upon this man to give him gratuitously a quarter of an hour's instruction every day, till he had made himself master of the Latin nouns and verbs. When he had advanced thus far, he dispensed with his instructer. Having purchased for a trifle an old dictionary, which had been very ill used, he considered himself to be in possession of all the necessary aid for commencing the work of translation; which, accordingly, he forthwith essayed, on the first Latin book he could obtain. This, it is related, happened to be no other than a Latin translation of Locke on the Human Understanding—the whole of which he toiled through. After this achievement, he applied himself to the Roman classics, and found that he could read them, in general, with ease and pleasure.

Mendelsohn's classical studies, had probably already begun to subject him to unpleasant suspicions and imputations, from the more bigoted among his Israelitish brethren. This may have been partly the reason that led him to attach himself, about this time, to a Polish Jew, of the name of Israel Moses, who had come to reside in Berlin, having been obliged to leave his native country in consequence of being supposed to hold opinions too liberal for the taste of the great majority of his nation. This person, among his other acquirements, was a proficient in the mathematics—a branch of learning of which, as yet, Mendelsohn knew nothing. On the other hand, Israel Moses was altogether ignorant of Latin. It was agreed, therefore, that the two friends should become each other's instructers. The Pole, accordingly, carried Mendelsohn through the elements of geometry, by means of a Hebrew translation of Euclid; and, in return, received lessons from the latter, in Latin and German. Such was the manner in which this ardent student availed himself of every chance opportunity of making a new acquisition, in useful or liberal knowledge—rarely having it in his power to travel towards his object by the most direct and usual road, but not deterred, on that account, from seeking it by any by-path, however circuitous, that lay open to him.

During the time he remained at Berlin, in obscurity and indigence, Mendelsohn's studies extended to many other subjects, besides those we have mentioned. In particular, he made himself familiar with both the French and English languages. But after several years had passed away, without improving his worldly circumstances, a rich Jew of the name of Bernard, who resided in the city, fortunately heard of his talents and his worth, and, being at the time in want of a tutor for his children, determined to employ him in that capacity. To poor Mendelsohn, this was, at that time, an elevation that satisfied his highest ambition. He had now, not only a comfortable home, but a salary which enabled him to buy books, and to take lessons in those branches of scholarship of which he was yet ignorant. It was after this, that he

began the study of the Greek language, to which he had not ventured to apply himself, so long as he was unable to obtain the assistance of a master. The duties of his situation allowed him considerable leisure, which he devoted, with his wonted ardor, both to various new departments of science and literature, and to the further prosecution of those upon which he had already entered. He thus extended his mathematical acquirements to algebra and fluxions; while natural philosophy, natural history, general-history, and metaphysics, all came in for a share of his attention.

Among his other accomplishments, were a remarkably beautiful handwriting, and great skill in accounts. Trivial as these acquirements may be deemed, it so turned out, that to them, principally, Mendelsohn was indebted for the prosperity of his future life. His diligence in the performance of his regular duties, and his excellent general conduct, soon raised him high in the favor of his employer; but that gentleman was particularly struck with the talent he displayed in the arts we have just mentioned. He at last resolved to remove him from the schoolroom to the countinghouse, and to employ him as one of his clerks. From this situation, he afterwards promoted him to a higher place in his establishment, which was a large silk-manufactory; and at last, he appointed him manager of the whole concern.

Mendelsohn was now in the enjoyment of a handsome income; but neither this, nor the laborious duties of his place, relaxed his diligence as a student. His evenings, and a great portion of the night, were still regularly given to literature and philosophy. He had long looked, with anxious and compassionate interest, upon the general ignorance of his Hebrew brethren; and the desire of diffusing among them the light of modern literature and science had become, as it continued to be throughout his life, the first wish of his heart. With this view, he projected, in conjunction with a friend, a Hebrew periodical work, to consist of short essays on such parts of science and morals as could most easily be made popular and interesting, to be entitled, 'The Moral Preacher.' Of

this work, however, the first in which Mendelsohn tried his powers as a public writer, only two numbers appeared; when he felt it prudent to discontinue it, in consequence of the outcry raised against it by his more bigoted brethren, to whom such an attempt to displace their ancient rabbinical manuals of instruction, seemed fraught both with presumption and profanity. But Mendelsohn, though turned from his course for the moment, was not thus to be driven to relinquish finally what he deemed to be as much the path of his duty, as it was of his ambition.

About the year 1754, an event took place, which greatly influenced Mendelsohn's future career; we mean, his introduction to Gotthold Ephraim Lessing, afterwards so celebrated among the literary ornaments of his country, but who was then, like his new friend, only a young man of twenty-five, and only beginning to be known as a writer. Mendelsohn is said to have been first made known to Lessing by a Jewish medical practitioner of the name of Gumpertz, by whom he had been assisted in learning some of the modern languages. They had also occasionally played at chess together; and it was as a proficient in this game, that the young Jewish philosopher was first recommended to the acquaintance of the future author of 'Nathan the Wise.' But these two congenial minds soon turned their intercourse to higher ends. To Mendelsohn, this connexion was especially important, inasmuch as it speedily introduced him to various other literary men, then residing in Berlin, to whose society, from their difference of religious creed, he would not otherwise have had access. In this manner, he became the intimate associate of Nicolai, Abbt, and others, who afterwards greatly distinguished themselves in the regeneration of the literature of their country. These young men were the principal supporters of various periodical works which then existed at Berlin; and Mendelsohn now joined his contributions to theirs. He had not yet, however, published any work in his own name; when one day his friend Lessing brought him a philosophical treatise, which had just been published, and requested him to read it and give his opinion of it. On returning the book, some days

afterwards, Mendelsohn observed, that he thought he could without much difficulty refute the author's positions. Encouraged by his friend, he accordingly sat down to the composition of his reply. When he had finished it, he brought the manuscript to Lessing, and requested him to be kind enough to read it, which the latter promised to do as soon as he should be at leisure. At their next interview, however, somewhat to Mendelsohn's surprise, the matter was never mentioned by Lessing; and Mendelsohn was too modest to introduce it himself. This happened several times; till at last, the anxious author ventured to ask his friend if he had found time to look to the manuscript. Lessing again complained of want of leisure; but promised him that he should certainly contrive to find time to read it immediately. "In the mean time," he added, "here is a small volume on the same subject, which has just appeared; take it home with you, and let me know what you think of it." Mendelsohn's surprise may be conceived, when, on opening this volume, he found it to be his own work, already in print,—his 'Philosophical Dialogues,' as he had entitled it. "Put it into your pocket," said Lessing, enjoying his amazement, "and this mammon along with it; it is what I got for the copy-right."

From this time, Mendelsohn took his place in the very front rank of the literary men of Germany. It does not, however, belong to this rapid sketch, even to enumerate the long succession of works by which, during almost every year of his remaining life, he sustained and added to his fame. For the classical elegance of his German style, he was considered as almost without a rival among his contemporaries. His treatise, in particular, on the immortality of the soul, entitled 'Phaedon,' attracted, immediately on its appearance, universal attention, and being translated into English, French, Dutch, Italian, Danish, and Hebrew, spread the fame of the author over all Europe. But the great effort of his life, still continued to be, the moral and intellectual improvement of his brethren of the house of Israel. For this purpose, he brought all the resources of his learning and genius to the

illustration of the Hebrew Scriptures; and his translations of the Books of Moses and the Psalms, the latter in verse, are reckoned among his very greatest performances. The incessant literary labors of this illustrious man, were often carried on, under the pressure of ill health, and always, amidst the interruptions of business or of society.

He eventually became the partner of Mr. Bernard in his silk-manufacturing establishment, and lived in the enjoyment of opulence. In his thirty-third year, he married, and had the happiness, before his death, of seeing his family growing up around him. One of his publications, which he entitles, 'Morning Hours,' consists of a series of lectures on natural philosophy, which he was for some years in the habit of delivering to his children every morning, for two or three hours after sunrise. His habits of living were extremely simple and abstemious. "It was inconceivable," says Mr. Samuels, to whose 'Memoir' we have been principally indebted for the above facts, "that the quantity of food to which he restricted himself, could sustain a human being; and at the same time it was affecting to see him press his guests, good humoredly, to partake of viands and liquors, which himself, though ever so desirous, durst not venture to taste. * * * He was very fond of company, and never courted solitude, except from four or five o'clock in the morning, till about eight or nine, when he adjourned to his counting-house, and remained there till noon. After dinner, he generally attended to business again, till about four in the afternoon. About this hour, his friends and pupils used to meet at his house; and, on his return, he usually found a numerous assembly in his room, who anxiously awaited his appearance. There were theologians, literati, philosophers, public functionaries, merchants, natives, foreigners, old and young, in promiscuous groups, with whom he conversed till eight o'clock, on various topics. Mendelsohn died, in consequence of a cold which he caught, in returning one morning from the synagogue, (in his attendance on which he was always extremely regular,) on the 4th of January, 1786, in the fifty-eighth year of his age.

CHAPTER X.

John of Salisbury; Roger Bacon.

THE persons with whom we have been occupied in the chapters immediately preceding the present, have all belonged to what may almost be called our own times; or, at least, their pursuits have been such as indicate an advanced state of literature, philosophy, and civilization generally. It is only within the last two or three centuries, that any thing like a spirit of independent speculation has formed a pervading characteristic of the literature of modern Europe. Up to that period, the intellect of our forefathers may be said, in most of its efforts, to have walked in leading-strings. The peculiar circumstances, in which literature sprung up, a second time, in western Europe, after the subversion of the Roman empire, sufficiently explain why it remained so long in a state of pupilage. But the extended period in modern history, called the Dark Ages, was only the night of the human mind, and by no means its sleep, as it has sometimes been described. The numbers of those who then dedicated themselves to literary pursuits, were very great, and their zeal and industry in many cases such as has never been surpassed.

As an evidence of the assiduity with which it was customary for men to apply themselves to the studies then in fashion, we may quote the account, which JOHN OF SALISBURY, who flourished in the twelfth century, gives us of the education he had received. "He says," (we quote the version of the original Latin, which Mr. Turner has given in his History of England,) "that in the year after Henry I. died, he went to the Peripatetic

School at Paris,* on the mount of St. Genevieve, and there studied logic; he afterwards adhered to Master Alberic, as *opinatissimus dialectus*, (a dialectician in the highest repute,) and an *acerrimus impugnator* (most keen impugner) of the nominal sect. He was two years with him and Robert Metridensis, an Englishman, both men *acuti ingenii* and *studii pervicacis*, (of acute genius and resolute studiousness.) He then, for three years, transferred himself to William de Conchin, to imbibe his grammatical knowledge. After this, he followed Richard, called the Bishop, retracing with him all he had learned from others, and the Quadrivium;† and also heard the German Harduin. He restudied rhetoric, which he had learned from Master Theodoric, and more completely from Father Helias. Being poor, he supported himself by teaching the children of the noble, and contracted an intimate acquaintance with Master Adam, an Englishman, and a stout Aristotelian. He prosecuted afterwards the study of logic with William of Soissons. Returning, at the end of three years, he heard Master Gilbert on logic and on Divine subjects; then Robert Pullen, and also Simon Periacensis, a faithful reader, but a heavy disputer. These last two were his only teachers in theology. Thus," he adds, "I passed twelve years, occupied by these various studies."

One of the most extraordinary individuals that appeared during the dark ages, was ROGER BACON; and his history affords us so admirable an example of the successful pursuit of knowledge, in the midst of all sorts of difficulties and discouragements, that we shall devote a few pages to present it with some fulness of detail. Bacon was born at Ilchester, in Somersetshire, in the year

* So translated by Mr. Turner; but the phrase in the original is *Ad peripateticum Palatinum*, which means '*to the Peripatetic of Palais*,' the common name by which the celebrated Abelard was known in that age, from his place of birth, Palais, in Bretagne.

† In the Middle Ages, all the branches of elementary education were considered as comprehended in the two great divisions called the *Trivium* and the *Quadrivium*; the former of which embraced grammar, logic, and rhetoric; and the latter, arithmetic, astronomy, geometry, and music.

1214. After remaining, for some years, at the University of Oxford, he went to finish his education at that of Paris, then the most distinguished seat of learning in Europe. Here he received his doctor's degree; after which, he returned to his own country, and, entering himself a brother of the Franciscan order, again took up his residence at Oxford. At this time, all the four orders of mendicant friars had establishments both at Oxford and Cambridge; and their members were, in truth, especially the Franciscans, the great support and ornaments of both Universities.

At the period, however, when Bacon commenced his career, the Aristotelian metaphysics and logic, although they had already begun to be studied, had not acquired in England that extraordinary ascendency, of which we find them only a few years after in possession. He, at all events, applied himself, from the first, chiefly to the mathematical and natural sciences, the principal of which, as cultivated at this time, may be enumerated under the heads of chemistry or alchymy, astronomy or astrology, medicine, and mechanics. To these, may be added, as having engaged a considerable share of Bacon's attention, the minor departments of geography, music, and optics; which last, especially, was one of his favorite studies, and that in which he displayed, more perhaps than in any other, his brilliant and inventive genius.

Nearly all these sciences were as yet mixed up with the wildest errors and follies, which were, however, universally looked upon as their most fundamental and unquestionable principles, and were accordingly steadily kept in view, by all who taught or studied either the theory or the practical applications of any of them. The grand object of chemistry, at the time to which we refer, was the discovery of the philosopher's stone, or the secret of manufacturing gold; but the experiments which were constantly making, with a view to this end, had incidentally given birth to some real discoveries, especially in regard to the fusibility, malleability, and other properties of the different metals. Of these, we may just state, that lead and copper were the two which the most perse-

vering efforts were made to convert into gold, the former exciting the hope of a favorable result by its great weight, and the latter by its color; no bad example of the purely imaginary grounds, which formed the whole theory and foundation of this art.

Medicine, was in much the same condition with chemistry, being studied, also, chiefly in the writings of the Arabian doctors, who had taken a particular pleasure in mystifying this science with all manner of occult speculations, and bedizening it with their frivolous fancies and inventions. Its natural alliance with chemistry, in the first place, subjected it to be corrupted by all the absurdities of the Hermetic philosophy.* But as these had originated chiefly in one of men's strongest passions, the love of wealth, so another passion still stronger, the fear of disease and death, operated in the case of medicine to give birth to a variety of other delusions, which retained their hold upon the public credulity with even yet more invincible obstinacy. In the unphilosophical times, to which we now refer, it was little more than a heap of quackeries and superstitions; or, at least, the truths which it taught, were so mixed up with the merest dreams and imaginations, and these latter were held to be so much the more important and essential part of it, that, if not the very vainest and falsest of all the sciences of the period, there certainly was no other, even as then studied, which was disfigured upon the whole, by more frivolity and nonsense.

As the chemists thought of nothing but their elixir, or universal solvent, of the metals, so the physicians had their elixir vitæ, or universal medicine, which was to cure all diseases, and, if not altogether to put an end to the custom of dying, at least to protract life to more than

* The science occupied with the pursuit of the philosopher's stone, was so called in memory of the Egyptian philosopher, Hermes, styled also Trismegistus, or the thrice-great, (supposed by some to be the same personage with the heathen god Mercury,) who, it was pretended, had first cultivated it about two thousand years before the birth of Christ, and to whom several existing works upon the subject were ascribed, although, it is almost needless to say, without any foundation.

antediluvian longevity. Then, the Arabian writers, in whose works the science was principally studied, had introduced into it a cloud of mystical and metaphysical notions, from those other departments of inquiry to which they were almost all of them attached. One of the greatest of the Arabian physicians, Avicenna, was one of the most devoted admirers that ever lived of the metaphysical works of Aristotle; which, however, he ingenuously confesses he had perused no fewer than forty times, before he understood them. Another of these doctors, Averroes, had written so many commentaries on the Greek philosopher, that he obtained the name of the most *Peripatetic** of the Arabians. Another of them, called Alcendi, or Alchindus, had a strange theory with regard to the virtues of medicines, maintaining that they could only be properly mixed according to the principles of music—a notion which seems intended to defy either explanation or comprehension.

But it was the intimate connexion it had formed with the philosophy of the stars, as then received, which gave to the medical science of the thirteenth and some succeeding centuries, the greater part of its weakness and absurdity. Medicine, in truth, was for a long time considered as only one of the branches of astronomy or astrology, terms which in those days were synonymous. One of Roger Bacon's own expressions is, that the most important department of astronomy is the science of medicine. Operations, accordingly, used to be performed, and remedies administered, not so much in conformity to the appearance or nature of the disease, as according to the aspect of the constellations. For it was the study of the influence, which the heavenly bodies were supposed to exert over human affairs, and the fortunes of individuals, that constituted the favorite astronomy of the times; or rather, no part of astronomy was studied at all, except with a view principally to the observation and detection of this imaginary sympathy between the stars and men.

* The philosophy of Aristotle was called the *Peripatetic*, from a Greek word signifying to *walk about*, because its founder was wont to walk about, while he conversed with and instructed his disciples.

In those days, this was not the belief, merely, of a few of the most ignorant and credulous of the vulgar, but the nearly universal creed even of the learned.

The science of judicial astrology, as it was called, from the judgements with respect to the future, which its professors pretended, by means of it, to draw from the stars, was imported into Europe, much about the same time with that of alchymy, and from the same Arabian school. The Arabian writers, however, had found it in the works of their predecessors, the disciples of the Greek school of Alexandria; and especially in their commentaries on a celebrated work, by the geographer Ptolemy, now commonly known by the name of his Almagestum, or Almagest, although that is only an Arabic term signifying, The Great Work, which was bestowed upon the book as a complimentary title by those who translated it into that language. The Almagest of Ptolemy, may, therefore, be considered as the grand source of all the astrological superstitions both of the East and of Modern Europe.

Bacon himself informs us, in one of his works, that, notwithstanding the state of unreclaimed barbarism, in which all the more important departments of learning still remained, there never had been known such an intellectual excitement as had arisen in his time. We have a gratifying proof of the zeal then felt in behalf of philosophy, and the honor in which it was held, in the reception Bacon is recorded to have met with, on his return from France to his own country, to which he was welcomed as one of the glories of the age; while a sum of money was immediately collected and given to him to enable him to prosecute those scientific investigations by which he had already acquired so much celebrity. He tells us himself, that, in the course of twenty years, he had been enabled, by this liberality of his friends, to expend, in collecting books, performing experiments, and constructing instruments, no less than two thousand pounds,—a much larger sum in those days, than in our own. Thus encouraged and supported, he pursued his researches in natural science for some time, without interruption, and with

a zeal and indefatigable application, to which the works he has left us, furnish abundant testimony.

Unfortunately, however, for his peace, though nothing that is recorded of him is more honorable to the purity and intrepidity of his moral character, he could not remain a silent witness of the disgraceful ignorance and profligacy of the generality of his ecclesiastical brethren; and his denunciations upon this subject became at last so loud and unguarded, that they reached the ears of those who were most certain both to feel their justice and never to forgive them. Immediately he felt what it was, to have provoked the hostility of so all-powerful a community as the Church then was, and to stand as a mark for both the open fury and concealed rancor of a body of men, kept united and powerful by their common interests and common fears, and having in their hands not only many of the terrors of civil authority, but the whole of that still more formidable power which belonged to an absolute supremacy over the creed, the consciences, and the passions of the people. The life of the philosopher becomes now, with little intermission, only a tale of persecution and cruel suffering. The ignorance and stupid bigotry of the times made it unhappily too easy a matter for his enemies to find the means of amply avenging themselves.

It was little more than a century, since the Pope himself had experienced how perilous a task he attempted, when he set about reforming the corruptions of the clergy. Gregory VII. had, about the time to which we refer, signalized his accession to the chair of St. Peter, by some strenuous endeavors to repress the abounding irregularities which had long pervaded all ranks of the priesthood; when both the inferior clergy and many of the bishops themselves, openly and indignantly repelled his interference, sarcastically replying to his exhortations and threatenings, by asking him, if he expected they were to live like angels. Nor was this all. The superior virtue and learning of the Pontiff served only to expose him to the blackest imputations. The first was represented as a mere show of austerity, artfully kept up to cover a life of real disso-

luteness. Of the other, advantage was taken to point him out to popular horror as a magician or necromancer, a charge under which his memory long labored, in common with that of some of the greatest men who were unfortunate enough to have lived in those dark times.

And this last was the very calumny, of which the enemies of Bacon availed themselves, in order to destroy him. His great reputation, as a master of the secrets of natural science, and the fame of his many ingenious experiments and contrivances, easily enabled them, in that ignorant age, to represent him both to the people and to the court of Rome, as working his wonders by supernatural means, and as actually in league with the devil. Nothing more was necessary to effect his ruin. An order arrived from the Pope, in the first instance, to restrain him from teaching, as he had been in the habit of doing, in the University; and a short time after, he was put in confinement, secluded from all intercourse with his friends, and, as we find him complaining, himself, subjected to such cruel privations that he was often near perishing of hunger. In this state, he remained probably for some years. Luckily, however, in the year 1264, the excellent and learned Cardinal Fulcodi, who had previously been Papal Legate in England, where he had known or heard of Bacon, became Pope, under the title of Clement IV.; and he, immediately on his accession, not only ordered the release of the philosopher, but took him under his especial protection. It was at the request of this Pontiff, that Bacon made that collection of his principal writings, known by the title of his *Opus Majus* or *Greater Work*, which, after remaining in manuscript for nearly five hundred years, was printed in London in the earlier part of the last century. It consists, in fact, of a discourse on the various subjects to which the author's studies had been directed, written in the form of a letter to the Pope; and while it repeats, as was to be expected, many things to be found in his other works, may be considered as the most complete and connected account of his whole system of philosophy, which has come down to us. But Clement reigned only about three years and a half; and with him,

expired Bacon's only security against the malevolence of his enemies.

It does not appear that he was positively molested, for some time ; but soon after the accession of Nicholas III. the General of his order, Jerome de Ascoli, ventured again to interdict the reading of his works, and to consign him to a prison, by a sentence which was confirmed by that Pontiff. Bacon was at this time in the sixty-fourth year of his age, and he remained in confinement for ten years. At last Jerome de Ascoli became himself Pope, under the title of Nicholas IV., and the persecuted old man, in the hope of being permitted to spend his few remaining days in freedom, stooped to appeal to the magnanimity of his former enemy, by addressing to him a treatise, which he had composed in his prison, on the means of avoiding the infirmities of Old Age, as a sample of the speculations to which he was wont to devote himself, and an evidence of the innocence and usefulness of those studies which had been so much calumniated. Whether the vanity or better feelings of Nicholas were actually touched by this submission to his judgement and compassion, does not very distinctly appear. It has been affirmed, that the appeal was powerfully backed by the intercession of some of Bacon's most distinguished countrymen ; but it is certain, at all events, that he soon after regained his liberty, and returned to his old residence at Oxford. Nor was he yet so completely worn out by age, hard study, and the cruelty of his oppressors, that he was ready only to lay himself down and die. On the contrary, it is ascertained that he lived about six years after his deliverance, in the course of which he composed and published his work, entitled 'A Compendium of Theology,' which still exists, in manuscript, in the King's Library. He died in the year 1294, at the age of eighty.

For the age in which he flourished, Bacon was a miracle, and altogether deserving of the title by which his contemporaries distinguished him—the *Wonderful Doctor*. In his genius and intellectual character, indeed, he did not belong to his age. He scarcely participated in its prevailing tastes, or gave himself at all to its favorite

studies. He complains, in one of his treatises, of the futile speculations, which passed under the name of learning and philosophy in his time; when the Roman law was the sole object of attention among secular scholars, and those of his own order occupied themselves about nothing, except the most perplexed subtilties of theology. Elegant literature and true science were alike neglected, on all hands. Even those, he tells us, who professed the warmest admiration and most earnest study of the works of Aristotle, had no acquaintance with that philosopher, except through the medium of translations, so wretched, that they seldom conveyed the meaning of their originals nor any other meaning. He asserts, in another place, that there were not above four scholars, in Christendom, who knew even the rudiments of either Greek or Hebrew, much less of Arabic; while the Latin itself was so imperfectly understood, that there was scarce one living writer, who expressed himself in it, with any degree of elegance or purity. Nor was the number of even tolerable mathematicians greater. Of those who applied themselves to that study, most stopped, he says, at the fifth proposition of Euclid. Hence this proposition used to be called the *Pons Asininus*, or *Asses' Bridge*, a name by which it is still known.

His own attainments, even as a scholar, to say nothing of his discoveries, were most extraordinary. He had travelled, indeed, the whole circle of literature and the sciences, in so far as it had been extended, in those days, and surpassed his contemporaries, as much in the depth and accuracy, as in the universality of his knowledge. His Latin style, though by no means perfectly classical, is distinguished by an ease, neatness, and perspicuity, which we look for, in vain, in almost any other writer of those days. He was distinguished, besides, for his knowledge of both the Greek and Hebrew languages, of the former of which he wrote a Grammar, which still exists in manuscript. It is remarkable for a curious passage it contains, in which it is gravely proposed, as a piece of ecclesiastical reform, that every bishop, in consecrating a church, should be obliged to

write the characters of the Greek alphabet on the floor, with the end of his pastoral staff, or, if that were too much for his scholarship, at least the three marks which were employed by the Greeks, in addition to their alphabetical characters, in the notation of numbers. The study of languages was one, indeed, to which Bacon had given a great deal of attention. It forms the subject of the third book of his *Opus Majus*, and its importance is there vindicated, by much ingenious and philosophical reasoning.

Ethics, theology, logic, and metaphysics, each of them enjoyed its share of the attention of this universal genius, as we learn either from those of his works that still exist, or from others, now lost, that are recorded to have been written by him. But it is his scientific researches and discoveries, that make the most brilliant part of his fame.

Some have gone so far as to consider Bacon the greatest mechanical genius that has appeared since the days of Archimedes. It is evident, from the testimony of his own writings, that he had at least speculated profoundly as to what might be done by mechanic power, and meditated many curious contrivances, some of which we can hardly doubt that he had actually executed, from the terms in which he speaks of them. In a little work, which he calls his 'Discovery of the Miracles of Art and Nature, and of the Nullity of Magic,' and which has been translated into English, he has a chapter on 'Admirable Artificial Instruments,' which, in reference to this point, is in the highest degree interesting. Among other machines which he speaks of, here, although he does not describe their construction, are, a ship, which might be managed by one man, as well as one of the common construction could by a whole crew; a chariot, which ran, with inconceivable swiftness, entirely by machinery; an apparatus for flying; and an engine for depressing or elevating the greatest weights by the application of a very small force, which he describes as only three fingers high and four broad. Another instrument, he says, may be easily made, whereby one man may, in

despite of all opposition, draw a thousand men to himself, or any other thing that is tractable. A contrivance to serve the same purpose as the modern diving bell, is also mentioned. "Such engines as these," he remarks, "were of old, and are made even in our days." All of them, he tells us, he has himself seen, "excepting only," he adds, "that instrument of flying," (we use the words of the old English translation,) "which I never saw, or know any who hath seen it, though I am exceedingly acquainted with a very prudent man who hath invented the whole artifice."

The errors into which this great man occasionally falls, read us a valuable lesson in the right method of philosophizing. He was, to an extent very remarkable, when we consider the age in which he lived, an experimental philosopher ;* but still he had not learned, by any means, the whole importance of that diligent inquisition of Nature, which was, some centuries later, demonstrated by his illustrious namesake, to be the one sure foundation of philosophy. There is one thing accordingly, with which we cannot fail to be struck, in following his speculations. His experiments are almost all directed, not to the *ascertainment* of principles, but only to their *exemplification*. It may sometimes have chanced, that he did, in this way, discover, or rather obtain a hint of, a new truth in science, or a hitherto unsuspected property in the substances or instruments he was employing ; but this was always merely an accidental result, and never the direct object of his examination of them. Hence, although he made some important additions to the truths of philosophy, he effected no diminution in the long list of errors and falsehoods by which it was in his time encumbered. With him, as with all his contemporaries, all was true that was generally believed, or that was to be found in any of those works which it was customary to regard as authorities. It is abundantly plain, that he had no clear conception

* "Whoever," says Mr. Hallam, "reads the sixth part of the 'Opus Majus,' upon experimental science, must be struck by it as the prototype, in spirit, of the Novum Organum."—*History of the Middle Ages*, ii. § 81.

of the true grounds of belief in philosophy. With all the ingenious and original views, accordingly, in which his writings abound, they contain, at the same time, it must be admitted, not a little of both hasty and extravagant inference. For not only does it never enter his imagination to doubt the correctness of any thing that has been stated by his predecessors, or to examine Nature with a view to ascertain the reality of those properties which they have imputed to her; but, with a corresponding ignorance, or disregard of the true laws of evidence, as to such matters, he continually advances to his general conclusions from much too limited an induction of particulars, and without any thing like a sufficient consideration of the whole circumstances, even of the cases to which his attention is directed. Thus, there can be little doubt that some, even of the mechanical designs we have just mentioned, were merely his imaginations of what might be accomplished by the most perfect combinations of certain natural powers, which, however, he had never actually applied, so as to produce such effects, nor contemplated very attentively, in any case, with reference to all the conditions of his supposed invention. It is with the same looseness, that we find him, in another place, asserting the possibility of making lamps that would burn for ever, and talking, on the authority of Pliny, of a certain stone which attracts gold, silver, and all other metals, "the consideration whereof," he remarks, with some simplicity, "makes me think there is not any thing, whether in divine or outward matters, too difficult for my faith." And, indeed, it appears to be so; for many of the stories which he quotes, especially those from Aristotle's *Secretum Secretorum*,* which is one of his greatest authorities, are such as one should think could hardly have failed to prove too monstrous for his belief, if it had not been of this infinite capacity.

The influence of this sanguine and over credulous disposition, is very discernible in his optical speculations

* Literally *The Secret of Secrets*,—a spurious production, attributed to Aristotle, in high favor in the dark ages, and filled with the most ridiculous marvels and absurdities.

He was here blinded and misled, in the most extraordinary manner, by certain notions he had imbibed, from the prevailing philosophy, upon the subject of what were called the *species* of objects, which were certain shadows, or images of themselves, which bodies of all kinds were imagined to be continually throwing off, and which, when received into the mind, constituted the *ideas* of the things from which they had come. In conformity with this singularly absurd theory, Bacon contends, that any object may reflect upon another the *species* or image of whatever power or quality is inherent in itself; that a man, for example, may, by means of words spoken under strong emotion, transmit to another object, no matter whether sentient or not, such an emanation of the passion under which he labors, that a certain effect, which he desires to operate on that object, shall be thereby immediately produced. If such a phenomenon as this, has never been actually exhibited, he conceives that it is owing solely to the emotion never having existed in sufficient intensity when the experiment was attempted. After this, we need not wonder at what he says about the reflective powers of mirrors. Glasses, he assures us, "may be framed to send forth species, and poisonous infectious influences, whither a man pleaseth; and this invention Aristotle showed Alexander, by which he erected the poison of a basilisk upon the wall of a city," &c. &c. In another place, we are informed, in a jargon which will scarcely bear translation, "that all things are to be known by the science of perspective, since all the doings of Nature take place through the multiplication of species and virtues from the agents of this world into the patients." And many other passages might be quoted, in the same style.

These were the prejudices of education, which even such a mind as that of Bacon was not powerful enough, altogether to escape from. They were in part, too, the natural produce of that sanguine temperament, which appertained to him as a man of inventive genius, and one given rather to look forward to the future, than back upon the past. The minds that have enlarged the bounds of sci-

ence, by positive discoveries, seem to be of a different order, from those to which we are indebted for the demolition of ancient systems of imposture or delusion. Lord Bacon, who first overthrew the despotism of Aristotle, and rid philosophy of the standard superstition, by which it had so long been encumbered and overshadowed, achieved nothing beyond the old border-line of the territory which he had thus cleared. Newton, on the other hand, whose conquests were all on the outer side of this hitherto untraversed bourn, might, possibly, had he lived in another age, have failed to detect those consecrated errors in the method of philosophizing, which were so happily exposed by Lord Bacon.

Astronomy is another of the departments of mathematical physics, in which Friar Bacon had made wonderful proficiency, for his age. As a proof of this, we may mention, that he is recorded to have suggested, in a letter to his patron, Clement IV., the same reformation of the Calendar, which was introduced, three hundred years afterwards, by Pope Gregory XIII., and which has been long adopted by nearly all Christendom, Russia being now the only country, in which the old reckoning prevails. Geography and chronology, were also favorite studies of Bacon's; and both are ably and learnedly treated of, among those of his works which still exist.

We have already mentioned the extraordinary imaginations, which, in those days, formed so important a part of physical science; and, in regard to most of these, this great man had not risen above the universal faith of his age. He was a believer in all the wild pretensions, both of astrology and alchymy. Of the latter art, indeed, he was one of the earliest disciples among the Latins, as the Christian inhabitants of Europe used then to be called, in contradistinction to the Jews and Saracens, by whom it had been cultivated for several centuries before. But it is unnecessary to refer more particularly to any of his unintelligible disquisitions on these subjects, which, couched as they generally are in a most peculiar and mystical style, seem, in truth, hardly intended to convey any meaning, even in the original, and certainly were

never meant to be translated. It is sufficient to remark, that the influence of the stars upon human affairs, is one of the fundamental laws of his astronomy; and that he has no doubt of the existence of a universal menstruum, or solvent, having the power both of converting all other metals into gold, and of purifying the human body from all its corruptions, and prolonging life through many ages.

In his pursuit of the philosopher's stone, however, Bacon had undoubtedly acquired a considerable knowledge of the properties of various natural substances, and made several real discoveries in chemistry. Of these, the most remarkable, of which his works give us any notice, is his discovery of gunpowder. We have no account, from himself, of the manner in which he arrived at this discovery; but nothing can be more probable, than the statement of another old writer, that he was indebted for it, merely to the accident of a vessel, in which the different ingredients of the composition happened to be mixed, exploding on being heated. The way in which he himself mentions the matter, is exceedingly curious, and very characteristic of the philosophy of the times. He describes the wonderful properties of his secret mixture in various parts of his works. For example, in his 'Treatise on the Miracles of Art and Nature,' he enumerates, among "his strange experiments," "The making of thunder and lightning in the air; yea, with a greater advantage of horror than those which are only produced by Nature; for a very competent quantity of matter, rightly prepared, (the bigness of one's thumb,) will make a most hideous noise and coruscation." In another place, he ventures so far, as to intimate, that the preparation in question is a compound of "nitre, or saltpetre, and *other ingredients*." In one passage, only, however, and that in a chapter thrown in by way of appendix, at the end of one of his works, does he actually record the names of these other ingredients. And even on this occasion, instead of declaring them plainly, and at once, he wraps them up in a mysterious *anagram*, or series of syllables, formed by an intricate transposition of the letters of which the words meant to be understood, are com-

posed. "The substance is prepared," says he, "from the *luru mope can ubre*, of saltpetre, and of sulphur." The sentence, of course, is in Latin; and the letters in italics, when restored to their proper order, make exactly the words *pulvere carbonum*, in English, the *powder of charcoal;* so that the meaning of the whole is, that the composition is formed, by mixing together the powder of charcoal, of saltpetre, and of sulphur, the very three ingredients, as is well known, from which gunpowder is generally made. This curious passage, proves, incontestably, Bacon's possession of the secret; but it is not at all probable that it is to him, or his writings, that the world at large has been indebted for the knowledge of it; for it is singular enough, that the barbarous syllables to which he thus confided it, retained their trust so faithfully, that they continued an unexplained riddle, for nearly five hundred years, when their meaning was at last discovered by the ingenious author of the article we have already referred to, in the *Biographia Britannica*. It may be added, that this mode of recording scientific discoveries was common long after the time of Bacon, as might be proved by many examples which it would be easy to cite. Newton himself first announced an important portion of his doctrine of fluxions by an anagram.

Bacon's renown, as a mighty magician, however, was the part of his fame that lived longest in the popular memory. It is entirely in this character, that he figures, in a very curious production, which appears to have been a great favorite with our ancestors, about the beginning of the seventeenth century, entitled, 'The famous history of Friar Bacon, containing the wonderful things that he did in his life; with the lives and deaths of the two conjurers, Bungey and Vandermast; very pleasant and delightful to be read.' This veracious chronicle, gives a most minute account of his fabrication of the marvellous brazen head, of which we read so much in all the old histories of the philosopher and his inventions. This fabrication of a brazen head, we may remark, is a feat which we find attributed to most of the few other individuals who were distinguished as cultivators of science, in those

times. William of Malmesbury, among the other wonders he relates, of the famous Gerbert, who became Pope under the title of Sylvester II., in the year 999, mentions such an image of his constructing, which was in the habit of answering many difficult questions. The same story is told of another very remarkable man, William of Paris, or of Auvergne, as he is sometimes called, who was born some years before Bacon, and has probably a better claim, than the English philosopher, to be accounted the father of alchymy, among the Latins, while he is at the same time honorably known as a most profound and original thinker on moral and metaphysical subjects, in an age when these departments of philosophy were especially under the control of routine and authority.

We read, too, of a brazen head, made by one of Bacon's patrons and most intimate friends, the celebrated Robert Grostete, or Greathead, Bishop of Lincoln, a prelate of great genius and learning, but who had made himself obnoxious, by his independent conduct, not only to the general body of the clergy, of whose corrupt manners he was a severe censor, but to the reigning Pope, Innocent IV., himself, some of whose impositions he had resisted, with a boldness that might surprise those who have so read the history of the Roman Catholic Church, as to have gathered no other notions with regard to it, except that of the unlimited authority of its head, and the uniform and unquestioning obedience of its inferior members. Bishop Greathead, often called Robert of Lincoln, wrote several works, which still exist, both in theology and science; and was distinguished, like his friend Bacon, for his philosophical as well as his mathematical knowledge. Lastly, we may mention the complete man of brass, made by the famous Albertus Magnus, or Albert the Great, of which it is recorded, that it was so fond of talking, that Thomas Aquinas, while a pupil of Albert's, one day knocked it to pieces, as a disturber of his studies. Albert was a contemporary of Friar Bacon's, and, like him, long enjoyed the reputation of profound skill in the art of magic. He was, undoubtedly, a very extraordinary man. The extent and variety of his attainments, seem to have been

wonderful, for the age in which he flourished; and his industry and fertility as a writer must be regarded as almost unparalleled, if he really composed the whole of that immense mass, which was printed at Lyons, in the middle of the seventeenth century, under the title of his collected Works, in twenty-one volumes, folio. A large portion of these, consists of Commentaries on Aristotle, whose works, however, he knew only through the medium of the wretched Latin translations then existing.

Attached, as Friar Bacon was, to those vain speculations known under the names of the sciences of astrology and alchymy, he was so far from ever pretending to operate by supernatural means, that one of his works, his 'Treatise on the Miracles of Art and Nature,' to which we have already referred, is written principally for the purpose of proving the nullity or absurdity of what was called the Art of Magic, and exposing the tricks of its professors. In the beginning of this little work, after enumerating the various methods by which these impostors pretended to perform their wonders, he affirms, that "no true philosopher did ever regard to work by any of these ways." And immediately after, nothing can be more sensible than the manner in which he expresses himself on the subject of charms, spells, &c. "Without doubt," says he, "there is nothing, in these days, of this kind, but what is either deceitful, dubious, or irrational, which philosophers formerly invented to hide their secret operations of Nature and art, from the eyes of an unworthy generation." The domination which he imagined the heavenly bodies to possess over human affairs, was certainly an absurd dream; and so was his other favorite fancy, about the tincture which possessed the power of curing all diseases, and turning every thing into gold; but neither of them proceeded upon the idea of any thing like supernatural or magical agency. The moral influence which he attributed to the stars, he conceived to be as truly a law of Nature, as that which directed their motions, or retained them in their orbits; and one, the operation and effects of which, equally admitted of being made matter of calculation and science. In the same manner, his

universal solvent, was merely one of the yet undiscovered essences or compounds of natural chemistry, the expectation of ever finding which, might be wild and unwarrantable enough, and the properties ascribed to it such, in fact, as nothing existing did actually possess; but still there was not necessarily any thing magical, either about the supposed nature of the substance, itself, or the manner in which it was to be applied, or even the processes and experiments by which it was sought to be discovered.

It is quite true that some of the other cultivators of these visionary sciences professed to avail themselves of the aid of spells or spirits, or other supernatural means, in prosecuting their researches; but Bacon never did. The worst that can be said of him is, that his language, when he is speaking of the subject, is occasionally somewhat mystical; which arises, in a great part, it is but fair to observe, merely from his employment of the peculiar and technical phraseology, of which the sciences in question, as well as all others, have their share. Nothing, therefore, could be more undeserved, than the opprobrium to which he was exposed, as a student of necromancy, or as one who ever even professed to work enchantments.

It has been said, that this calumny only arose many years after his death, and that he himself never was annoyed by it; but both his history and his writings, we cannot help thinking, prove the contrary. In his book on Old Age, he distinctly complains of being hindered from making such experiments as he would have wished, by "the rumors of the vulgar." And in various other passages, we find him alluding to the difficulties and dangers which philosophy had to encounter from the same cause. It is gratifying, however, to observe, that, in whatever spirit this accusation may have been originally brought against him, and with however much affected horror his name may have long been regarded by his brother Churchmen, who used to nail his books, we are told, to the shelves of their libraries, and to allow them to remain in that state covered with dust, and a prey to the moths and worms, he seems, even in his character of a magician, to have been a favorite with the people in gen-

eral. In 'The Famous History of Friar Bacon,' instead of being represented as in league with the powers of evil, we find him, on various occasions, opposing and foiling them, in a style that would do honor to any legendary saint in the calendar; and when his fellow conjurers, Bungey and Vandermast, are consigned, at the close of their career, to the usual fate of persons of their craft, he is, by an extraordinary piece of indulgence on the part of the chronicler, released from the dreadful penalty, by being made, in a fit of repentance, to burn his books of magic, to turn anchorite, and to study divinity. Every thing that is told of him, too, speaks in favor of the kind and generous manner in which he used to dispense his enchantments; and, upon the whole, he is represented to us, in point of moral character, very much in the same light in which his own writings, so evidently the produce of a simple, benevolent, and philosophic spirit, would lead us to regard him. He was, indeed, a genuine lover of knowledge and philosophy, for which he was ever ready to suffer all things; preferring them infinitely to all things. He unfolds to us, in short, very clearly, what manner of man he must have been, by a single remark, when, speaking of one of his projects or contrivances, he calls it, with delightful enthusiasm, "an invention of more satisfaction to a discreet head, than a king's crown."

CHAPTER XI.

Optical Discoveries:—Spectacles; Magnifying or Burning Glasses; Camera Obscura; Telescope. Professors of Optical Discovery:—Dollond; Ramsden; Sir W. Herschel; Fraunhofer; Thomas Phelps and John Bartlett; Palitzch.

THE truth, as we have already remarked, with regard to many of the inventions mentioned by Friar Bacon,

probably is, that he had rather deduced them, as possibilities, from the philosophical principles in which he believed, than actually realized them experimentally. Among others, certain optical instruments, to which he attributes very wonderful powers, existed merely, there can be little doubt, as conceptions of his mind, and had never been either fashioned or handled by him.

The invention of spectacles, however, may be considered as having been traced, on evidence of unusual clearness, in such matters, to about the time of the death of Bacon. By the testimony of more than one contemporary writer, this useful contrivance is assigned to a Florentine named Salvini degl' Armati; although he, it is said, would have kept the secret to himself, had it not been for another subject of the same state, Father Alexander de Spina, who, having found it out by the exertion of his own ingenuity and penetration, was too generous to withhold from the world so useful a discovery. This was about the close of the twelfth century. From this time, magnifying, or burning, lenses continued to be made of various sizes. But nearly three hundred years more, elapsed, before any additional discovery of much importance was made in optical science; although, in the early part of the sixteenth century, Mamolicus of Messina, and, soon after him, Baptista Porta, began once more to direct attention to its principles by their writings and experiments. The latter is said to have first performed the experiment of producing a picture of external objects on the wall of a darkened chamber, by the admission of the light through a lens fixed in a small circular aperture of the window-shutter, the origin of the modern Camera Obscura; and the former made an imperfect attempt to explain the phenomenon of the rainbow. The fortune of ascertaining the true principles of this phenomenon, however, was reserved for Antonio de Dominis, Archbishop of Spalatro, who published his exposition of them in the year 1611.

It appears to have been about this time, also, or not long before, that the telescope was invented; although the accounts that have come down to us regarding this matter are extremely contradictory. As magnifying lenses

had been long known, and were commonly in use, nothing is more probable than that, as has been suggested, more than one person may, ere this, have accidentally placed two lenses, in such a position as to form a sort of rude telescope; and this may account for various evidence that has been adduced, of something, resembling this invention, having been in use at an earlier period. But what is certain, is, that the discovery of the telescope which made it generally known, took place only about the close of the sixteenth century. It seems, also, to be generally agreed, that it was in the town of Middleburg, in the Netherlands, that the discovery in question was made; and moreover, that it was made by chance, although the accounts vary as to who was the fortunate author of it. The story commonly told, is, that the children of a spectacle-maker, while playing in their father's shop, having got possession of two lenses, happened accidentally to hold them up at the proper distance from each other, and to look through them at the weather-cock on the top of the steeple; when, surprised at seeing it apparently so much nearer and larger than usual, they called to their father to come and witness the phenomenon; after observing which, he was not long in fabricating the first telescope. The wonderful powers of the new instrument, were soon rumored over Holland and other countries, and the account excited every where the greatest interest and curiosity. At last, as we have mentioned in our former volume, it reached Galileo, at Venice; and he reinvented the instrument by the application of his own sagacity and scientific skill.

The microscope was also discovered about this time; —but by whom, is equally uncertain. These instruments, however, contributed greatly to revive a taste for optical investigations; and some of the greatest philosophers of the time, especially Kepler and Des Cartes, successively distinguished themselves in this branch of science, so that some of its most important principles were, ere long, much more accurately ascertained, than they had hitherto been, and the phenomena depending upon them, more correctly explained. The early part of the seventeenth

century, indeed, exhibits one of the busiest periods in the whole history of optical discovery; nor did the almost constant advance of the science stop, till the publication of the Dioptrics of Des Cartes, in 1637.

Its next distinguished cultivator, was James Gregory, whose Optics appeared in 1663. It was he, as is well known, who first proposed the reflecting telescope, which, on that account, is often called by his name, although he did not succeed in actually constructing such an instrument. This was first accomplished, a few years afterwards, by Sir Isaac Newton, whose investigations on the subject of light, in its whole extent, were destined to create, in regard to that department of physics, nearly as complete a change in the opinions of the age as that which he subsequently effected, by the publication of his 'Principia,' in regard to the mechanism of the heavens. By his celebrated experiment of interposing a prism, or triangular bar of glass, in the way of the solar beam, admitted through a small hole into an otherwise darkened chamber, he had made it produce on the wall, not a white circle, as it would have done if allowed to pass on without interruption, but an elongated image, or spectrum, as he called it, displaying a series of seven different colors, namely, red, orange, yellow, green, blue, indigo, and violet,—hence often spoken of as the seven prismatic colors. This phenomenon proved the hitherto unsuspected facts; first, that white or common light, is, in reality, composed of seven different species of rays; and, secondly, that each of these several rays is refrangible in a different degree from the others, that is to say, on passing into a new medium, they do not proceed together, in one direction, but each, starting from the common point of entrance, takes a separate course of its own, so that the beam spreads out into the resemblance of a fan. This is called the divergence, or *dispersion* of the rays of light; and, from some other experiments which Newton made, he was induced to believe, that whatever transparent substances or media *refracted* a beam of light in the same degree, or, in other words, changed in the same degree its general direction, were also equal in their *dispersive*

powers, or made the different rays separate from one another to the same extent. From this, followed a very important consequence. The magnifying powers of the common telescope depended entirely upon the refraction of the light in its passage through the several lenses ; but it could not undergo this operation, without the rays being at the same time dispersed ; and this necessarily threw a certain indistinctness over the image which such telescopes presented to the eye. Here, therefore, was a defect in the refracting telescope, which admitted of no cure ; for the dispersive bearing the same relation in all substances to the refractive power, you could not obtain the requisite refraction without its inseparable companion, the same amount of dispersion. It was this consideration, which made Newton give up all thoughts of improving the refracting telescope, and apply himself, as Gregory had done, to the construction of one, which should present its image, not by refracting, but by reflecting, the light from the object.

This rapid sketch of the progress made in the improvement of the telescope up to the beginning of the eighteenth century, will be sufficient to enable the unscientific reader to understand the general nature and importance of a very happy discovery, which, since that time, has so greatly improved that instrument, and of the author of which, one of the most remarkable examples of self-educated men, we are now about to give some account.

JOHN DOLLOND was born in Spitalfields, England, on the 10th of June, 1706. His parents came from Normandy, on the revocation of the Edict of Nantes, in 1685 ; and, along with many thousands more of their countrymen, established themselves in the above-named district of the English metropolis, in their original business of silk-weavers. Dollond's earliest years, also, were spent at the loom ; and it had become the more necessary that he should apply himself to his occupation, with his utmost industry, in consequence of his father having died, while he was yet an infant. Even during his boyhood, however, we are told, he began to show an inclination for the study of the mathematics ; and before he was fifteen, he

used to amuse himself, during what little leisure he could command, in constructing sundials and solving geometrical problems, although, at this time, he had scarcely had an opportunity of looking into any book on these subjects. These early habits of study, he continued as he grew up towards manhood; so that, notwithstanding the disadvantages under which he labored, he had, ere long, accumulated a considerable store of learning on his favorite subjects of inquiry. He married early, and an increasing family forced him to make still more unremitted exertions for their support,—so that, although he seems now to have become a master manufacturer, he had still less time for private study than ever. But the leisure which business deprived him of during the day, he procured for himself, as many other ardent students have done, by stealing it from the hours usually allotted to sleep. In this manner he continued to improve himself in geometry and algebra; after which he applied himself to different branches of natural philosophy, and with especial ardor, it is recorded, to the kindred departments of astronomy and optics. But Dollond's studies at this time were not confined even to what is commonly called science. He found time to attain a competent knowledge of anatomy, to read a great deal of divinity, and even without any instructer to make himself so far master of the Greek and Latin languages, as to enable himself to translate the New Testament from the one into the other.

Such a man was destined for something above the handicraft to which he had been bred. Dollond, however, pursuing all the while his solitary studies, continued in his original business, even for some years after his eldest son Peter was come to an age to join him in it. But Peter had also been his father's associate in his philosophical inquiries and experiments; and the tastes, as well as the knowledge, which he had thus acquired, naturally made him feel ambitious of entering upon some other line of exertion, in which his talents and attainments might find a more appropriate employment, than his father's business afforded. So, after having been for some time in partnership with his father, he determined to set up, on

his own account, as an optician. He was at this time, only about twenty years of age, and does not appear to have received any other instructions in the art he had resolved to follow, than those which his father had given him. But his ingenuity, skill, and diligence, were speedily crowned with the success they deserved. So great was the encouragement he received, indeed, that after a short while it was arranged that his father should join him; and accordingly, in the year 1752, John Dollond gave up his old business of a silk-manufacturer, and entered again into partnership with his son as an optician.

Being now free to devote his whole attention to the art, and the sciences connected with it, which had for so many years occupied his scanty leisure, he was not long in displaying the powers of his cultivated and inventive genius, by various improvements on the instruments which he fabricated. Of these, however, we can only afford space to notice the one from which his name derives its chief distinction.

We have stated, above, the conclusion to which Newton had arrived, in regard to the dispersive power of different substances, namely, that it always bore a certain relation to the refractive power; and the inference which he thence drew, as to the impossibility of improving the common or refracting telescope. In consequence of this decision of Newton, the attention of the students of optical science was, for a considerable time after, principally directed to the simplification of the reflecting telescope. But this instrument, especially when constructed of a large size, was attended with many inconveniences in the management, and, from the difficulty of keeping the mirrors clean, was extremely liable to get out of order. The reflected light, besides, was never so strong as that obtained by refraction. Notwithstanding, therefore, the colored fringe in the image formed by the refracting telescope, that instrument still continued to be generally used for ordinary purposes. At length, the distinguished mathematician, Euler, undiscouraged by the circumstance which had made Newton give up the same task in despair, resolved once more to make some attempt to correct the

peculiar imperfection which had hitherto attached to it. He began his experiments, about the year 1747; but, after continuing them for several years, he failed in obtaining any success. He published, however, several speculations upon the subject, in the Berlin Memoirs, which excited very general interest in the scientific world. In these papers, he announced and proceeded upon a certain law with regard to the relation between the refractive and dispersive powers; and it was on the subject of this assumed principle of calculation, that he was first opposed by Dollond. The ground, which the English optician took, was, that Euler's asserted law, was irreconcilable with one of the experiments recorded by Newton—as in truth it was; but the experiment in question, and Dollond's inference from it, Euler attempted to show were alike inadmissible, on considerations which appeared to him to demonstrate the self-contradiction to which they led. Dollond's paper, with Euler's reply, appeared in the Philosophical Transactions for 1752; so that the controversy must have been commenced by Dollond some time before he set up as a regular optician.

It was some years after this, that the Swedish mathematician, Klingenstierna, in a paper which he sent to the French Academy of Sciences, demonstrated, on purely geometrical considerations, the inadmissibility of the law which Dollond had deduced from the experiment made by Newton. Dollond, who had not been convinced by Euler's calculations, could not resist this new proof of the incorrectness of the principle which he had hitherto advocated; but, as it was a direct consequence, and acknowledged by all to be so, of what Newton had stated as the result of his experiment, it followed, of course, that this great observer had, for once, deceived himself; and that the only way to determine the point, was to have recourse again to the fountain-head of all philosophy, the testimony of Nature.

It is a striking evidence of the habitual reverence felt for Newton's accuracy, that, during all the time this dispute had been carried on, no one had till now adventured upon the task of following his footsteps over this intricate

ground, and so tracing out where he had erred. This, however, Dollond at last determined to do; and having begun his experiments in the year 1757, he prosecuted them in the spirit, as he says himself, of "a resolute perseverance;" till, at length, after he had devoted nearly all his time to that one object, for about a year and a half, in June, 1758, he found himself in a condition to lay before the Royal Society, as the result of his investigations, a new discovery, of the most interesting nature.

The experiments which he had made had refuted, not only the law which he had himself advanced with regard to the relation between the refractive and dispersive powers, but also, and as completely, that which had been propounded by his opponent. Both these deductions had been equally founded on the assumption, sanctioned by the authority of Newton, that these two powers actually did always bear a certain relation to each other; but Dollond had now discovered that the amount of the one was, in fact, altogether independent of that of the other; that where two substances, in other words, had the same, or nearly the same, refracting power, their powers of dispersion might nevertheless be widely different; and conversely.

Crown-glass and flint-glass, for instance, he found to differ very slightly in their power of refracting, or turning aside from its original course the entire beam of light which entered them from another medium; while, in dispersing the several rays of which it was composed, or, to repeat the figure we have already used, spreading them out into a fan, the former produced only two-thirds of the effect produced by the latter, so that, when the rays were allowed to arrange themselves in a colored spectrum, that image was, in the one case, a third longer than it was in the other.

The discovery of this hitherto unsuspected principle, gave a new aspect to the whole subject of refraction, and at once pointed out the method to be adopted in order to remedy the great defect of the refracting telescope. To retain the requisite degree of refraction, and at the same time to get rid of the dispersion of the rays, it was necessary only to form the lens of two different glasses, or

other transparent substances, so arranged, that the dispersive powers of the one should counteract those of the other, while the refraction, or at least a sufficient amount of it, remained undestroyed. There were many experiments, it is true, to be made, before the idea, thus suggested, could be practically realized; but the perseverance and ingenuity of the same mind, which had discovered the principle, at length succeeded also in triumphing over the difficulties that lay in the way of its application. Dollond was not long in producing refracting telescopes, which presented images retaining scarcely a perceptible remnant of that colored border always existing in the old instruments. When the successful result of his attempts was first reported abroad, many of the continental mathematicians refused for some time, to give credit to his alleged discovery; and Euler, in particular, was still so prepossessed in favor of his own hypothesis, which the new doctrine overthrew, that he continued, for several years, to hold, that the greater distinctness of the images in Dollond's telescopes, arose from some other cause than the correction of the unequal refrangibility of the rays. This illustrious philosopher, however, at last became convinced of his error, and frankly acknowledged it.

For this great discovery, the Royal Society presented Dollond with the Copley Medal. The new telescope, to which the name of *Achromatic*, or *Colorless*, has been given, was afterwards considerably improved by its inventor; and has, since his time, been brought by others to still greater perfection. Meantime, it spread the fame of the English optician over Europe, and gave him, at once, a high rank among the philosophers of his age. In 1761, he was elected a Fellow of the Royal Society, and appointed Optician to his majesty. But he did not live long, to enjoy these honors. On the 30th of November, in the same year, while perusing a newly-published mathematical disquisition, on which he had been engaged for a considerable time, he was suddenly struck with apoplexy, and died in a few hours. His son, who had been so long associated with him, carried on the busi

ness for many years, in such a manner as fully to sustain the reputation of the establishment, and died but a few years since.

The mention of Dollond naturally recalls the name of another of the most eminent of the English opticians, the late Mr. JESSE RAMSDEN, who, in like manner, was not originally bred to the profession, which he followed with such distinguished success. Ramsden was born in 1735, at Salterhebble, near Halifax, where his father kept an inn. The education he received in his boyhood, embraced both a little Latin and the elements of geometry and algebra. But when he was of the usual age for being put to a business, his father took him from school, and bound him apprentice to a clothier in Halifax; and in this line he continued till he reached his twentieth year, when he came up to London, and obtained employment, as a clerk, in a wholesale warehouse. He held this situation for about two years and a half; but in the mean time, he had industriously availed himself of what leisure he could command, to renew and extend his acquaintance with science, and so enamored did he gradually become of these pursuits, that he at last resolved to make an effort to establish himself in some line more closely connected with his favorite studies, than that which he had heretofore followed. With this view, notwithstanding that he was now so far beyond the age at which the learning of a business is usually begun, he bound himself apprentice for four years, to Mr. Burton, of Denmark-court, a mathematical instrument maker.

On the expiration of this term, he and a fellow-workman of the name of Cole, entered into business together, Ramsden serving the other as journeyman at a salary of twelve shillings per week. This connexion, however, did not last long; and on its termination, Ramsden opened a shop of his own. His chief employment, for some time, consisted in repairing optical and other mathematical instruments, which had got out of order; and in this, the industry and ability he displayed, soon brought him into notice, and procured him a rapidly increasing business. But he did not rest satisfied with merely perform-

ing, in a superior manner, such work as he undertook of this description; the different instruments which passed through his hands, forcibly attracted his attention to the imperfections by which each happened to be characterized, and called his powers of contrivance into exercise, in devising how they might be improved. In order to accomplish himself the more completely for this task, he labored assiduously, till he acquired, entirely by his own application, the art of grinding glass, and of handling the file, the lathe, and the other instruments used by opticians. Thus furnished with the practical skill and dexterity requisite to enable him to apply his ingenuity and mathematical knowledge, he proceeded to enter upon a regular and comprehensive examination of all the different optical instruments in use, with a view to the remedying of their several defects.

This resolution, and the perseverance with which it was followed up, eventually made Ramsden one of the greatest optical mechanicians that the world has ever produced. The list of the instruments, which are indebted to him for the most ingenious and valuable improvements, embraces nearly all those of greatest importance and most common use in astronomy, and the connected sciences. Hadley's quadrant, the sextant, the theodolite, the barometer, the transit instrument, and many others, too numerous to specify, all came out of his hands, it might almost be said, with new powers, and certainly, at all events, with much more, in every case, than they before possessed, both of manageableness and of accuracy. In this last respect, especially, the instruments constructed by him far surpassed any that had before been produced; and they were indebted for much of their superiority to a new dividing or graduating engine which he had contrived, the principle of which was extremely ingenious. It consisted essentially of a marker, moved forward by the turning of a very fine-threaded screw. It is easy to make a screw with a hundred turns of the thread in an inch; and by attaching to it a handle or index of sufficient length, so that the extremity may be over a properly divided circle of considerable magnitude, the movement of such a

screw may be regulated with perfect precision to the thousandth part of one of its entire revolutions. Now, as by such a revolution it would only advance the marker the hundredth part of an inch, it is evident, that, by being turned only the thousandth part of an entire revolution, every time the marker is allowed to descend and make an impression upon the plate of metal, or other surface to be divided, a hundred thousand equidistant lines may actually be drawn upon every inch of that surface.

For this most useful contrivance, the Board of Longitude awarded him a premium of £615; and in return he engaged to graduate whatever sextants were put into his hands, for that purpose, at the rate of three shillings a-piece. His engine, indeed, enabled him to perform the operation in about twenty minutes, whereas it had been wont to occupy many hours. But the additional accuracy which was given to the instrument to which it was applied by the new method, was of still greater importance than its comparative expedition and cheapness. Hadley's quadrant, for instance, used to be so coarsely divided, and in other respects so defectively made, before it received Ramsden's improvements, that, in endeavoring to ascertain the longitude by it, the observation might in some cases lead to an error of fifty leagues; but Ramsden constructed it in so superior a manner, that even his commonest instruments did not admit of an error being fallen into of more than the tenth part of that amount, and with those of a more expensive description, accuracy was insured in all cases to within a single league.

Soon after he commenced business, Ramsden married Miss Dollond, daughter of the inventor of the achromatic telescope, part of the patent for which, came in this way into his possession. In 1786, he was elected a Fellow of the Royal Society, having been proposed by his friends without his knowledge, after his diffidence in his claims to such a distinction had made him long withhold his consent to their taking that step. In 1794, he was chosen a member of the Imperial Academy of Sciences at Petersburg; and in 1795, the Royal Society awarded him the gold medal, annually bestowed by them for eminence in science.

The Rev. Lewis Dutens, the author of the 'Researches on the Origin of Discoveries,' who was intimately acquainted with Ramsden, has given us an account of his friend, which contains some interesting particulars of his character and habits. After noticing his great activity, the uncommon force of his reasoning powers, and the accurate and retentive memory with which he was endowed, the writer proceeds to remark, that, perhaps, after all, the most distinguishing quality of his mind was a certain elegance, and taste for precision and high finish, which appeared not more in the instruments he manufactured than in every thing he did. "This feeling for perfection," Mr. Dutens goes on to say, "led him, in the most minute and insignificant parts of his instruments, to a polish and grace, which sometimes tempted those to smile who did not perceive that the same principle which enabled him to carry the essential parts of his instruments to a degree of perfection unknown, and considered as impossible before his time, induced him to be dissatisfied if a blemish of any sort, even the most trifling, appeared to his exquisite eye.

To these uncommonly strong natural endowments, he added all that the most constant and intense study could bestow. Temperate, to abstemiousness, in his diet, satisfied with an extremely small portion of sleep, unacquainted with dissipation or amusement, and giving but very little time even to the society of his friends, the whole of those hours, which he could spare from the duties of his profession, were devoted either to meditation on further improvements of philosophical instruments, or to the perusal of books of science, particularly those mathematical works of the most sublime writers which had any connexion with the subjects of his own pursuits. Mr. Ramsden's only relaxation, from these constant and severe studies, was the occasional perusal of the best authors both in prose and verse; and when it is recollected, that at an advanced age, he made himself so completely master of the French language, as to read with peculiar pleasure the works of Boileau and Moliere, he will not be accused of trifling even in his lighter hours. Short and temperate

as were his repasts, a book or a pen was the constant companion of his meals, and not seldom brought on a forgetfulness of hunger; and when illness broke his sleep, a lamp and a book were ever in readiness to beguile the sense of pain, and make bodily sickness minister to the progress of his mind.

"Of the extent of his mathematical knowledge, he was always, from innate modesty, averse to speak, although I have heard him say, that he never was at a loss when his profession required the application of geometry. His knowledge in the science of optics is well known to have been perfect; and when we add, that the works of Bouguer and the great Leonard Euler were his favorite study, we shall not lightly rate his proficiency in mathematics. Of his skill in mechanics it is unnecessary to speak. Nor let it be supposed that his science in his profession was limited to the higher branch of invention and direction of the labors of others. It is a wellknown fact, that such was his own manual dexterity, that there was not any one tool, in any of the numerous branches of his profession, which he could not use with a degree of perfection, at least equal to that of the very best workman in that particular branch; and it is no exaggeration to assert that he could, with his own hands, have begun and finished every single part of his most complicated instruments. It may not be foreign to this part of his character, to observe, that his drawings were singularly neat and accurate, and his handwriting so beautiful, that, when he chose to exert his skill, few writing-masters could equal it."

In order to insure that perfect accuracy which it was his object to give to every instrument he sold, Ramsden had all the parts of the work done under his own inspection; and for this purpose, he kept men of every necessary branch of trade in his establishment. He availed himself, also, to the utmost, of the advantages to be derived from the division of labor—allotting to every workman his particular department, from which he was never called away to another. He employed about sixty men in all; but such was his reputation over all Europe, and so numerous were the orders he received, that, even with this

large establishment, he found it impossible to execute them with the requisite expedition. About this, indeed, he did not give himself much trouble; what alone he cared for, was, that every instrument which bore his name should be worthy of his reputation, no matter what time or pains it should cost to make it so.

No man was ever more nobly indifferent to the mere pecuniary gains of his art. If he had been anxious to enrich himself, he might have easily accumulated a large fortune; but for that object, he would have had to enlarge his already extensive establishment so much further, that his personal superintendence of every part of it would have been impossible. So far was he from being influenced by any views of this kind, that it is asserted he never executed any one of the many great works, for which he received commissions from public bodies, both in his own and other countries, without being a loser by it as a tradesman. When an instrument did not answer his expectations, he never hesitated to take it to pieces, or to destroy it, whatever had been the cost bestowed upon its construction. Admirable as all his instruments were, too, for their accuracy, their high finish, their durability, and all the other qualities that make up the excellence of such productions, he generally put a less price upon them—in some cases a much less price—than was charged for inferior works, of the same kind, by other artists.

Mr. Ramsden died on the 5th of November, 1800, at Brighton, to which place he had gone, a short time before, with the view of recovering his health, which, never vigorous, had latterly been greatly impaired by his unremitting exertions. He died possessed of only a small fortune; and, in the spirit in which he had lived, he left the greater part of it to be divided among his workmen, in proportion to their merits and their length of service.

One of the very greatest names in the modern history of astronomical discovery, is that of the late illustrious Sir William Herschel; and he also was self-instructed in the science in which he earned his high reputation. Herschel was born at Hanover, in 1738, and was the son

of a musician in humble circumstances. Brought up, as well as his three brothers, to his father's profession, for which, it has been said, that he qualified himself without much teaching, he was placed, at the age of fourteen, in the band of the Hanoverian Guards. A detachment of this regiment having been ordered to England, in the year 1757, (or, according to another account, in 1759,) he and his father accompanied it; but the latter returned to Germany, in the course of a few months, and left his son, in conformity with his own wish, to try his fortune in London. For a long time, the young man had to struggle with many difficulties; and he passed several years, principally in giving lessons in music to private pupils, in the different towns of the north of England. At last, in 1765, through the interest of a gentleman to whom his merits had become known, he obtained the situation of organist at Halifax; and next year, having gone to fulfil a short engagement at Bath, he gave so much satisfaction by his performances, that he was appointed to the same office, in the Octagon Chapel of that city, upon which he went to reside there. The place which he now held, was one of some value; and, from the opportunities which he enjoyed, besides, of adding to its emoluments, by engagements at the rooms, the theatre, and private concerts, as well as by taking pupils, he had the certain prospect of deriving a good income from his profession, if he had made that his only or his chief object.

But long before this, his active and aspiring mind had begun to direct its attention to other pursuits, offering a wider scope for the exercise of its talents. While yet only an itinerant teacher of his art, in country towns, Herschel had assiduously devoted his leisure, not only to the making himself more completely master of the language of his adopted country, but also to the acquiring of a knowledge of the Italian, the Latin, and even the elements of the Greek. At this time, probably, he looked to these attainments, principally with a view to the advantage he might derive from them in the prosecution of his professional studies; and it was no doubt with this view, also, that he afterwards applied himself to the perusal of

Dr. Robert Smith's 'Treatise on Harmonics,' one of the most profound works on the science of music which then existed in the English language. But the acquaintance he formed with this work, was destined ere long to change altogether the character of his pursuits. He soon found that it was necessary to make himself a mathematician, before he could make much progress in following Dr. Smith's demonstrations. He now, therefore, turned with his characteristic alacrity and resolution to the new study to which his attention was thus directed; and it was not long before he became so attached to it, that almost all the other pursuits of his leisure hours were laid aside for its sake.

During his residence at Bath, although greatly occupied with professional engagements, the time he devoted to his mathematical studies was rather increased than diminished. Often, we are told, after a fatiguing day's work, of fourteen or sixteen hours, among his pupils, he would, on returning home at night, repair, for relaxation, to what many would deem these severer exercises. In this manner, in course of time, he attained a competent knowledge of geometry, and found himself in a condition to proceed to the study of the different branches of physical science which depend upon the mathematics. Among the first of these latter that attracted his attention, were the kindred departments of astronomy and optics. It has been stated by Lalande, that Herschel's first attempts in the fabrication of magnifying-glasses were occasioned by his reading something upon that subject in a copy of Smith's Optics, which accidentally fell in his way; but this story is perhaps nothing more than a version of the fact already mentioned, that his acquaintance with the mathematics, began in his study of the 'Treatise on Harmonics,' by the writer in question. Another account of the matter, which has been given in the London Annual Biography, is, that, having in the course of his philosophical studies applied himself to the sciences of optics and astronomy, he became desirous of beholding, with his own eyes, those wonders of the heavens, of which he read so much, and for that purpose, he borrowed from an acquaint-

ance a two-feet Gregorian telescope. This instrument interested him so greatly, that he determined to procure one of his own, and commissioned a friend in London to purchase one for him, of a somewhat larger size. But he found the price was beyond what he could afford. To make up for this disappointment, he resolved to attempt to construct a telescope for himself; and after encountering innumerable difficulties in the progress of his task, he at last succeeded, in the year 1774, in completing a five-feet Newtonian reflector. This was the beginning of a long and brilliant course of triumphs in the same walk of art, and also in that of astronomical discovery.

Herschel now became so much more ardently attached to his philosophical pursuits, that, regardless of the sacrifice of emolument he was making, he began gradually to limit his professional engagements, and the number of his pupils. Meanwhile, he continued to employ his leisure in the fabrication of still more powerful instruments than the one he had first constructed; and in no long time, he produced telescopes of seven, ten, and even twenty feet focal distance. In fashioning the mirrors for these instruments, his perseverance was indefatigable. For his seven-feet reflector, it is asserted, that he actually finished and made trial of no fewer than two hundred mirrors, before he found one that satisfied him. When he sat down to prepare a mirror, his practice was to work at it for twelve or fourteen hours, without quitting his occupation for a moment. He would not even take his hand from what he was about, to help himself to food; and the little that he ate on such occasions, was put into his mouth by his sister. He gave the mirror its proper shape, more by a certain natural tact, than by rule; and when his hand was once in, as the phrase is, he was afraid that the perfection of the finish might be impaired by the least intermission of his labors.

It was on the 13th of March, 1781, that Herschel made the discovery to which he owes, perhaps, most of his popular reputation. He had been engaged for nearly a year and a half in making a regular survey of the heavens, when, on the evening of the day that has been mentioned, having

turned his telescope (an excellent seven-feet reflector, of his own construction,) to a particular part of the sky, he observed, among the other stars, one which seemed to shine with a more steady radiance than those around it; and, on account of that and some other peculiarities in its appearance, which excited his suspicions, he determined to observe it more narrowly. On reverting to it, after some hours, he was a good deal surprised to find that it had perceptibly changed its place—a fact which, the next day, became still more indisputable. At first, he was somewhat in doubt whether or not it was the same star which he had seen on these different occasions; but, after continuing his observation for a few days longer, all uncertainty upon that head vanished. He now communicated what he had observed, to the Astronomer Royal, Dr. Maskelyne, who concluded that the luminary could be nothing else than a new comet. Continued observation of it, however, for a few months, dissipated this error; and it became evident that it was, in reality, a hitherto-undiscovered planet. This new world, so unexpectedly found to form a part of the system to which our own belongs, received from Herschel the name of the *Georgium Sidus*, or Georgian Star, in honor of the King of England; but by other astronomers it has been more generally called either *Herschel*, after its discoverer, or *Uranus*. Subsequent observations, made chiefly by Herschel himself, have ascertained many particulars regarding it, some of which are well calculated to fill us with astonishment at the powers of the sublime science which can wing its way so far into the immensity of space, and bring us back information so precise and various. In the first place, the diameter of this new globe has been found to be nearly four and a half times larger than that of our own. Its size, altogether, is about eighty times that of our earth. Its year is as long as eighty-three of ours. Its distance from the sun, is nearly eighteen hundred millions of miles, or more than nineteen times that of the earth. Its density, as compared with that of the earth, is nearly as twenty-two to one hundred; so that its entire weight is not far from eighteen times that of our planet. Finally, the force

of gravitation near its surface is such, that falling bodies descend only through fourteen feet, during the first second, instead of thirty-two feet, as with us. Herschel afterwards discovered, successively, no fewer than six satellites, or moons, belonging to his new planet.

The announcement of the discovery of the *Georgium Sidus*, at once made Herschel's name universally known. In the course of a few months, the King of Great Britain bestowed upon him a pension of three hundred pounds a-year, that he might be enabled entirely to relinquish his engagements at Bath; and upon this, he came to reside at Slough, near Windsor. He now devoted himself entirely to science; and the constructing of telescopes, and the observation of the heavens, continued to form the occupations of the remainder of his life. Astronomy is indebted to him for many other most interesting discoveries besides the celebrated one, of which we have just given an account, as well as for a variety of speculations of the most ingenious, original, and profound character. But of these, we cannot here attempt any detail. He also introduced some important improvements into the construction of the reflecting telescope, besides continuing to fabricate that instrument of dimensions greatly exceeding any that had been formerly attempted, and with powers surpassing, in nearly a corresponding degree, what had ever before been obtained. The largest telescope, which he ever made, was his famous one forty feet long, which he erected at Slough, for the King. It was begun about the end of the year 1785, and on the 28th of August, 1789, the enormous tube was poised on the complicated, but ingeniously contrived mechanism, by which its movements were to be regulated, and ready for use. On the same day a new satellite of Saturn was detected by it, being the sixth which had been observed attendant upon that planet. A seventh was afterwards discovered by means of the same instrument. This telescope has since been taken down, and replaced by another, of only half the length, constructed by Mr. J. Herschel, the distinguished son of the subject of our present sketch. Herschel, himself, eventually became convinced that no telescope could

surpass in magnifying power, one of from twenty to twenty-five feet in length. The French astronomer, Lalande, in his continuation of Montucla's History of the Mathematics, states, that he was informed by George III., himself, that it was at his desire that Herschel was induced to make the telescope at Slough of the extraordinary length he did, his own wish being that it should not be more than thirty feet long.

So extraordinary was the ardor of this great astronomer in the study of his favorite science, that for many years, it has been asserted, he never was in bed, at any hour during which the stars were visible. And he made almost all his observations, whatever was the season of the year, not under cover, but in his garden, and in the open air—and generally without an attendant. There was much, that was altogether peculiar to himself, not only in the process by which he fabricated his telescopes, but also in his manner of using them. One of the attendants in the King's observatory at Richmond, who had formerly been a workman in Ramsden's establishment, was forcibly reminded, on seeing Herschel take an observation, of a remark which his old master had made. Having just completed one of his best telescopes, Ramsden, addressing himself to his workmen, said, "This, I believe, is the highest degree of perfection that we, opticians by profession, will ever arrive at; if any improvement of importance, shall ever, after this, be introduced in the making of telescopes, it will be by some one who has not been taught his art by us."

Some years before his death, the degree of Doctor of Laws was conferred upon Herschel by the University of Oxford; and in 1816, the then Prince Regent, afterwards George IV., bestowed upon him the Hanoverian and Guelphic Order of Knighthood. He died on the 23d of August, 1822, when he was within a few months of having completed his eighty-fourth year.

To this distinguished name, and those of Dollond and Ramsden, it would be easy, if our space permitted, to add those of many other self-taught cultivators of the same departments of science. Among more recent opticians,

no one has attained a higher eminence, either as an artist or as a scientific experimentalist and speculator, than FRAUNHOFER, the late superintendent of the establishment for the manufacture of optical glasses at Munich, who rose from the condition of a common workman.

Of astronomical observers, again, some might also be mentioned, who have been of very humble station. There is a print—a copy of which may be seen in the rooms of the [London] Astronomical Society—of two very remarkable individuals, who were employed, during a considerable part of the last century, in the Earl of Macclesfield's observatory, at Sherburn, England. The elder of these, as the inscription below the engraving informs us, was named THOMAS PHELPS, and he, it is stated, "from being a stable-boy, in the year 1718, to the then Lord Chief Justice Parker, afterwards Earl of Macclesfield, rose by his merit to the upper employments in the family, and at last, for his uncommon genius, was promoted to be Observer in the observatory at Sherburn Castle." Phelps, it is added, was born at Chalgrove, in Oxfordshire, in January, 1694, and was in his eighty-second year, when his portrait was taken.

The other, JOHN BARTLETT, is described as having been "originally a shepherd, in which station, he, by books and observation, acquired such a knowledge in computation, and of the heavenly bodies, as induced the late George, Earl of Macclesfield, to appoint him Assistant Observer in his observatory at Sherburn Castle." Bartlett was born at Stoke Talmage, in Oxfordshire, August 22, 1721, old style, and was in his fifty-fourth year, at the time his picture was taken. In the print, Phelps is represented as standing and looking through a telescope, while Bartlett is sitting by him with his tablets, or a sheet of paper, in the one hand, and a pen in the other, ready, seemingly, to note down what his associate may announce. There is a penetrating eagerness and sagacity, in the eye and general aspect of the old man; and that of the other is also a striking head, with a less keen and vivacious physiognomy than Phelps, but more massive, and indicating, perhaps, more a meditative and cal-

culating mind. In a manuscript note, on the back of the copy of this print, which belongs to the Astronomical Society, it is stated, that "Phelps was the person, who, on the 23d of December, 1743, discovered the great comet, and made the first observation of it; an account of which is contained in the Philosophical Transactions, but not the name of the observer."

The comet of 1758, so famous in consequence of its return having been predicted more than half a century before, by the great astronomer, Halley, was also, it may be remarked, first perceived by an observer in an humble rank of life. It was on the 25th of December, in that year, that the luminary in question was detected with only the naked eye, at Prohlis, near Dresden, by a Saxon peasant, of the name of PALITZCH, at a time, when all the greatest astronomers in Europe were seeking for it in vain, with their telescopes. Nor did Palitzch owe his discovery merely to his superior powers of vision. This Saxon peasant was really an astronomer. "George Palitzch," says Lalande, "born in the obscure condition of a common laborer, had succeeded both in finding happiness in his humble lot, and in acquiring various branches of knowledge, which are rarely found possessed by men of higher stations who have had the advantage of a careful education. More in the way of being struck with the spectacle of the heavens, than if he had lived in a town, he had, by his own efforts, studied and made himself master of astronomy, as well as those parts of geometry, such as plane and spherical trigonometry, upon which it depends. By the exertion of a meritorious economy, he had formed, for himself, an observatory, furnished with the instruments most important for the pursuit of his favorite study. Few opportunities of making interesting observations escaped him; and, notwithstanding this, his occupations as an agriculturist were duly attended to. Natural History and Botany were also among the studies in which he took great delight; and he had a very-well-arranged cabinet of natural productions, as well as a garden full of rare plants, which he carefully cultivated. He was distinguished by such exceeding modesty, that he always refused

even to give any details of his life, notwithstanding they must have been so full of interest. Such was the astronomer and philosopher Palitzch, to whom was reserved the honor of being the first of all the astronomers of Europe, in the discovery of the return of this anxiously expected comet." Palitzch, we may add, who was born in 1723, continued to cultivate astronomy, as well as his garden and his fields, for many years after this event,—and died, at last, in his native village, in 1788. He had been, for some time, a corresponding member both of the Royal Society of London and of the Imperial Academy of St. Petersburg.

CHAPTER XII.

Discovery and Improvement of the Steam Engine:— James Watt.

ALL the inventions and improvements of recent times, if measured by their effects upon the condition of society, sink into insignificance, when compared with the extraordinary results which have followed the employment of steam as a mechanical agent. To one individual, the illustrious JAMES WATT, the merit and honor of having first rendered it extensively available for that purpose are preeminently due.* The force of steam, now so important an agent in mechanics, was nearly altogether overlooked, until within the last two centuries. The only application of it, which appears to have been made by the ancients, was in the construction of the instrument which they called the Æolipile, that is, the Ball of Æolus. The Æolipile consisted of a hollow globe of metal,

* [For a notice of the merits of Fulton, and other Americans, in relation to the employment of steam power, see the LIFE OF FULTON, (particularly chap. vi.) in Vol. I. of 'Lives of Eminent Individuals,' forming Vol. IV. of 'THE SCHOOL LIBRARY.'—AM. ED.]

with a long neck, terminating in a very small orifice, which, being filled with water and placed on a fire, exhibited the steam, as it was generated by the heat, rushing, with apparently great force, through the narrow opening. A common tea-kettle, in fact, is a sort of Æolipile. The only use, which the ancients proposed to make of this contrivance, was, to apply the current of steam, as it issued from the spout, by way of a moving force—to propel, for instance, the vans of a mill, or, by acting immediately upon the air, to generate a movement opposite to its own direction.

But it was impossible that they should have effected any useful purpose, by such methods of employing steam. Steam depends so entirely for its existence in the state of vapor, upon the presence of a large quantity of heat, that it is reduced to a mist or a fluid, almost immediately on coming into contact either with the atmosphere, or any thing else which is colder than itself; and in this condition its expansive force is gone. The only way of employing steam with much effect, therefore, is to make it act in a close vessel. The first known writer who alludes to the prodigious energy, which it exerts when thus confined, is the French engineer, Solomon de Caus, who flourished in the beginning of the seventeenth century. This ingenious person, who went to England in 1612, in the train of the Elector Palatine, afterwards the son-in-law of James I., and resided there for some years, published a folio volume, at Paris, in 1623, on moving forces; in which he states, that if water be sufficiently heated in a close ball of copper, the air or steam arising from it will at last burst the ball, with a noise like the going off of a petard. In another place, he actually describes a method of raising water, as he expresses it, by the aid of fire, which consists in the insertion, in the containing vessel, of a perpendicular tube, reaching nearly to its bottom, through which, he says, all the water will rise, when sufficiently heated. The agent here is the steam produced from part of the water by the heat, which, acting by its expansive force upon the rest of the water,

forces it to make its escape in a jet through the tube.* The supply of the water is kept up through a cock in the side of the vessel.

Forty years after the publication of the work of De Caus, appeared the Marquis of Worcester's famous 'Century of Inventions.' Of the hundred new discoveries, here enumerated, the sixty-eighth is entitled, 'An admirable and most forcible way to drive up water by fire.' As far as may be judged from the vague description which the Marquis gives us of his apparatus, it appears to have been constructed upon the same principle with that formerly proposed by De Caus; but his account of the effect produced, is considerably more precise than what we find in the work of his predecessor. "I have seen the water run," says he, "like a constant fountain-stream, forty feet high; one vessel of water rarefied by fire, driveth up forty of cold water." This language would imply that the Marquis had actually reduced his idea to practice; and if, as he seems to intimate, he made use of a cannon for his boiler, the experiment was probably upon a considerable scale. It is with some justice, therefore, that, notwithstanding the earlier announcements in the work of the French engineer, he is generally regarded as the first person who really constructed a steam-engine.

About twenty years after this, namely, in the year 1683, another Englishman, Sir Samuel Morland, appears to have presented a work to the French King, containing, among other projects, a method of employing steam as a mechanic power, which he expressly says he had himself invented, the preceding year. The manuscript of this work is now in the British Museum; but it is remarkable, that when the work, which is in French, was afterwards published by its author, at Paris, in 1685, the passage about the steam-engine was omitted. Sir Samuel

* In the same work, De Caus proposes another apparatus for raising water, simply by the pressure upon its surface, in a close vessel, of the air rarefied by the heat of the sun. This process may be often observed, taking place on a small scale, in what is called the Fountain Ink-glass, in which, in a warm day or a heated room, the liquid will be forced up sometimes to the very lip of the spout, by the expansion of the superjacent air within the vessel.

Morland's invention, as we find it described in his manuscript treatise, appears to have been merely a repetition of those of his predecessors, De Caus and the Marquis of Worcester; but his statement is curious, as being the first, in which the immense difference between the space occupied by water in its natural state, and that which it occupies in the state of steam, is numerically designated. The latter, he says, is about two thousand times as great as the former; which is not far from a correct account of the expansive force that steam exerts under the ordinary pressure of the atmosphere. One measure of water, it is found, in such circumstances, will produce about seventeen hundred measures of steam.

The next person, whose name occurs in the history of the steam-engine, is Denis Papin, a native of France, but who spent the part of his life during which he made his principal pneumatic experiments, in England. Up to this time, the reader will observe, the steam had been applied directly to the surface of the water, to raise which in the form of a jet, by such pressure, appears to have been almost the only object contemplated by the employment of the newly-discovered power. It was Papin who first introduced a piston into a tube or cylinder which rose from the boiler. This contrivance, which forms an essential part of the common sucking pump, is merely, as the reader probably knows, a block fitted to any tube or longitudinal cavity, so as to move freely up and down in it, yet without permitting the passage of any other substance between itself and the sides of the tube. To this block, a rod is generally fixed; and it may also have a hole driven through it, to be guarded by a valve, opening upwards or downwards, according to the object in view.*

Long before the time of Papin, it had been proposed to raise weights, or heavy bodies of any kind, by suspending them to one extremity of a handle or cross-beam, attached, at its other end, to the rod of a piston moving in this manner in a hollow cylinder, and the descent of which, in order to produce the elevation of the weights, was to be effected by the pressure of the superincumbent

* See an explanation of the valve at p. 77.

atmosphere, after the counterbalancing air had been by some means or other withdrawn from below it. Otto Guericke used to exhaust the lower part of the cylinder, in such an apparatus, by means of an air-pump. It appeared to Papin that some other method might be found, of effecting this end, more expeditiously and with less labor. First, he tried to produce the requisite vacuum, by the explosion of a small quantity of gunpowder, in the bottom of the cylinder, the momentary flame occasioned by which, he thought, would expel the air through a valve opening upwards in the piston, while the immediate fall of the valve, on the action of the flame being spent, would prevent its reintrusion. But he never was able to effect a very complete vacuum by this method. He then, about the year 1690, bethought him of making use of steam for that purpose. This vapor, De Caus had long ago remarked, was recondensed and restored to the state of water by cold ; but up to this time, the attention of no person seems to have been awakened to the important advantage that might be taken of this one of its properties. Papin, for the first time, availed himself of it in his lifting machine, to produce the vacuum he wanted. Introducing a small quantity of water, into the bottom of his cylinder, he heated it by a fire underneath, till it boiled and gave forth steam, which, by its powerful expansion, raised the piston, from its original position in contact with the water, to a considerable height above it, even in opposition to the pressure of the atmosphere on its other side. This done, he then removed the fire, on which the steam again became condensed into water, and occupying now about the seventeen hundredth part of its former dimensions, left a vacant space, through which the piston was carried down, by its own gravitation and the pressure of the atmosphere.

The machine, thus proposed by Papin, was abundantly defective in the subordinate parts of its mechanism, and, unimproved, could not have operated with much effect. But, imperfect as it was, it exemplified two new principles, of the highest importance, neither of which appears to have been thought of, in the application of the power

of steam, before his time. The first, is the communication of the moving force of that agent, to bodies, upon which it cannot conveniently act directly, by means of the piston and its rod. The second, is the deriving of the moving force desired, not from the expansion of steam, but from its other equally valuable property of condensibility, by mere exposure to cold. Papin, however, it is curious enough, afterwards abandoned his piston and method of condensation, and reverted to the old plan, of making the steam act directly, by its expansive force, upon the water to be raised. It is doubtful, however, whether he ever actually erected any working engine upon either of these constructions. Indeed, the improvement of the steam-engine could scarcely be said to have been the principal object of those experiments of his, which, nevertheless, contributed so greatly to that result. It was, in fact, as we have seen, with a view of perfecting a machine, contrived, originally, without any reference to the application of steam, that he was first induced to have recourse to the powers of that agent. The moving force with which he set out, was the pressure of the atmosphere; and he employed steam, merely as a means of enabling that other power to act. Even by such a seemingly subordinate application, however, of the new element, he happily discovered, and bequeathed to his successors, the secret of some of its most valuable capabilities.

We may here conveniently notice another ingenious contrivance, of essential service in the steam-engine, for which we are also indebted to Papin—we mean the safety-valve. This is merely a lid or stopper, closing an aperture in the boiler, and so loaded as to resist the expansive force of the steam up to a certain point, while, at the same time, it must give way and allow free vent to the pent-up element, long before it can have acquired sufficient strength to burst the boiler. The safety-valve, however, was not introduced into the steam-engine, either by Papin, or for some years after his time. It was employed by him, only in the apparatus still known by the name of his *digester*, a contrivance for producing a very

powerful heat, in cookery and chemical preparations, by means of highly-concentrated steam.

We now come to the engine invented by Captain Savery, in 1698. This gentleman, we are told, having one day drunk a flask of Florence wine at a tavern, afterwards threw the empty flask upon the fire, when he was struck by perceiving that the small quantity of liquid, still left in it, very soon filled it with steam, under the influence of the heat. Taking it up, again, while thus full of vapor, he now plunged it, with the mouth downwards, into a basin of cold water, which happened to be on the table; by which means, the steam being instantly concentrated, a vacuum was produced within the flask, into which the water immediately rushed up, from the basin. According to another version of the story, it was the accidental circumstance of his immersing a heated tobacco-pipe into water, and perceiving the water immediately rush up through the tube, on the concentration by the cold of the warm and thin air, that first suggested to Savery the important use that might be made of steam, or any other gas expanded by heat, as a means of creating a vacuum. He did not, however, employ steam for this purpose in the same manner that Papin had done. Instead of a piston moving under the pressure of the atmosphere, through the vacuum produced by the concentration of the steam, he availed himself of such a vacuum merely to permit the rise of the water into it from the well or mine below, exactly as in the common suction pump.* Having thus raised the water to the level of the boiler, he afterwards allowed it to flow into another vessel, whence he sent it to a greater height, by the same method which had been many years before employed by the Marquis of Worcester,—namely, by making the expansive force of the steam act upon it, directly, and so force it up, in opposition to its own gravity and the resistance of the atmosphere.

Savery showed much ingenuity and practical skill, in contriving means of facilitating and improving the working of the apparatus which he had devised upon these

* See Pursuit of Knowledge, vol. i. pp. 19, 20.

principles; and many of his engines were erected, for supplying gentlemen's houses with water, and other purposes, in different parts of the country. The machine also received many improvements after the death of the original inventor. It was considerably simplified, in particular, by Dr. Desaguliers, about the year 1718; and this gentleman also contrived a method of concentrating the steam by the injection of a small current of cold water into the receiver, instead of the old method employed by Savery, of dashing the water over the outside of the vessel, which cooled it to an unnecessary degree, and occasioned, therefore, a wasteful expenditure of fuel. It was Desaguliers who first introduced the safety-valve into the steam-engine, although Papin had previously suggested such an application of the contrivance. Engines upon Savery's principle, have continued to be constructed, down to our own times; and, as they can be made at a comparatively small expense, they are found to answer very well, in situations where water has to be raised only a short way. This engine is, in fact, merely a combination of the common sucking-pump, (except that the requisite vacuum is produced by the condensation of steam, and without the aid of a piston,) with the contrivance proposed by De Caus and the Marquis of Worcester for the application of the expansive force of steam; and, wherever the machine can be economically employed, the former part of it, is that which operates with by far the most effect.

Not long after Savery had invented his engine, Thomas Newcomen, an ironmonger, and John Calley, a glazier, both of Dartmouth, in Devonshire, began also to direct their attention to the employment of steam as a mechanical power. Their first engine was constructed about the year 1711. This contrivance, which is commonly known by the name of Newcomen's engine, proceeded mainly upon the principle formerly adopted by Papin, but subsequently abandoned both by him and those who immediately followed him in the cultivation of this department of mechanics, of making the moving power of the machinery, the weight of the atmosphere acting

upon a piston, so as to carry it down through a vacuum created by the condensation of the steam. Newcomen's apparatus is, on this account, often distinguished by the name of the Atmospheric engine. Its inventors, however, instead of adopting Papin's clumsy method of cooling his steam by the removal of the fire, employed, in the first instance, the expedient of pouring cold water on the containing vessel, as Savery had done before them, though without being aware, it is said, of his prior claim to the improvement. They afterwards exchanged this for the still better method, already described as introduced by Desaguliers into Savery's engine, of injecting a stream of water into the cylinder, which is said to have been suggested to them by the accident of some water having found admission to the steam through a hole which happened to have worn itself in the piston. This engine of Newcomen, which, in the course of a very few years after its invention, was brought to as high a state of perfection as the principle seems to admit of, afforded the first important exemplification of the value of steam in mechanics. Savery's, the only other practical contrivance which had been proposed, had been found quite inadequate to the raising of water from any considerable depth, its principal power, as we have already remarked, lying, in fact, in the part of it which acted as a sucking-pump, and by which, as such, water could only be raised till its column was of equal weight with a column of the atmosphere of the same base.* It was nearly useless, therefore, as an apparatus for pumping up water from mines; the grand object for which a moving force of extraordinary power was at this time in demand. But here Newcomen's engine proved of essential service. Many mines, that had long remained unwrought, were, immediately after its invention, again rendered accessible, and gradually excavated to great depths; while others were opened, and their treasures sought after with equal success, which but for its assistance could never have been attempted. It was applied also to various other important purposes.

* See Pursuit of Knowledge, vol. i. p. 20.

Newcomen's engine, however, notwithstanding its usefulness, especially in cases where no other known power could be applied, was still, in some respects, a very defective contrivance, and by no means adapted to secure the complete command of the energies of steam. The great waste of fuel, in particular, which was still occasioned by the degree to which the cylinder was cooled after every stroke of the piston, from the cold water injected into it, rendered it scarcely any saving of expense to employ this engine, in circumstances where animal power was available. Its whole force too, the reader will observe, as a moving power, was limited to what could be obtained by atmospheric pressure, alone, which, even could the vacuum under the piston have been rendered quite perfect, and all obstructions from friction annihilated, could only have amounted to about fifteen pounds for every square-inch of the surface of the piston. The expansive force of steam was not, in fact, at all employed in this contrivance as a moving power; could the vacuum necessary to permit the descent of the piston have been as expeditiously and conveniently produced by any other agency, that of steam might have been dispensed with altogether. An air-pump, for instance, attached to the lower part of the cylinder, as originally proposed by Otto Guericke, might have rendered all the service which steam was here called upon to perform; and in that case, this element, with the fuel by which it was generated, might have been dispensed with, and the machine would not have been a steam-engine at all.

This view of the matter may, in some degree, account for the complete neglect of steam as a moving power, which so long prevailed after Newcomen's engine was brought into use, notwithstanding the proofs of its capabilities in that character which had been afforded by the attempts of the earlier speculators. It was now regarded, simply as affording the easiest means of obtaining a ready vacuum, in consequence of its property of rapid condensation on the application of cold: its other property, of extraordinary expansion, which had at first attracted to it the attention of mechanicians, and presented

in reality a much more obvious application of it as a mechanical agent, had been entirely neglected. The only improvements of the engine which were attempted, or thought of, were such as referred to what may be called its subordinate mechanism, that is to say, the contrivances for facilitating the alternate supplies of the steam and the water on which its action depended; and after Mr. Beighton had, about the year 1718, made the machine itself shut and open the cocks by which these supplies were regulated, instead of having that service performed as at first by an attendant, there remained little more to be done, even in this department. The steam might be applied with more ease and readiness, but not with any augmentation of effect; the power of the engine could be increased only by a more plentiful application of atmospheric pressure. It was with propriety, therefore, that Newcomen's invention was called not a steam, but an atmospheric, engine.

For half a century, accordingly, after the improvements introduced by Beighton, who may be considered as the perfecter of this engine, no further progress, worth mentioning, was made in the application of steam as an agent in mechanics. The engine itself was more and more extensively employed, notwithstanding its defects; but no better method was proposed, of calling into exercise the stupendous powers of the element, which, by means of only one of its remarkable properties, was here shown to be capable of rendering such valuable service. Our knowledge of what might be done by steam, was in this state, when the subject at last happily attracted the attention of Mr. Watt.

James Watt was born at Greenock, Scotland, on the 19th of January, 1736. His father was a merchant, and also one of the magistrates of that town. He received the rudiments of his education in his native place; but his health being even then extremely delicate, as it continued to be to the end of his life, his attendance at school was not always very regular. He amply made up, however, for what he had lost in this way, by the diligence with which he pursued his studies at home, where, with-

out any assistance, he succeeded, at a very early age, in making considerable proficiency in various branches of knowledge. Even at this time, his favorite study is said to have been mechanical science, to a love of which, he was probably, in some degree, led, by the example of his grandfather and his uncle, both of whom had been teachers of the mathematics, and had left a considerable reputation for learning and ability in that department. Young Watt, however, was not indebted to any instructions of theirs for his own acquirements in science, the former having died two years before, and the latter the year after he was born.

At the age of eighteen, he was sent to London, to be apprenticed to a maker of mathematical instruments; but in little more than a year, the state of his health forced him to return to Scotland; and he never received any further instruction in his profession. A year or two after this, however, a visit which he paid to some relations in Glasgow, suggested to him the plan of attempting to establish himself in that city, in the line for which he had been educated. In 1757, accordingly, he removed thither, and was immediately appointed mathematical instrument maker to the College. In this situation, he remained for some years, during which, notwithstanding almost constant ill health, he continued both to prosecute his profession, and to labor in the general cultivation of his mind, with extraordinary ardor and perseverance. Here also he enjoyed the friendship and intimacy of several distinguished persons who were then members of the University, especially of the celebrated Dr. Black, the discoverer of the principle of latent heat, and Mr. (afterwards Dr.) John Robison, so well known by his treatises on mechanical science, who was then a student, and about the same age with himself. Honorable, however, as his present appointment was, and important as were many of the advantages to which it introduced him, he probably did not find it a very lucrative one; and therefore, in 1763, when about to marry, he removed from his apartments in the University to a house in the city, and entered upon the profession of a general engineer.

For this, his genius and scientific attainments admirably qualified him. Accordingly, he soon acquired a high reputation, and was extensively employed in making surveys and estimates for canals, harbors, bridges, and other public works. His advice and assistance, indeed, were sought for, in almost all the important improvements of this description, which were now undertaken or proposed in his native country. But another pursuit, in which he had been for some time privately engaged, was destined, ere long, to withdraw him from this line of exertion, and to occupy his whole mind, with an object still more worthy of its extraordinary powers.

While yet residing in the College, his attention had been directed to the employment of steam, as a mechanical agent, by some speculations of his friend, Mr. Robison, with regard to the practicability of applying it to the movement of wheel-carriages; and he had, also, himself made some experiments with Papin's digester, with the view of ascertaining its expansive force. He had not prosecuted the inquiry, however, so far as to have arrived at any determinate result, when, in the winter of 1763–4, a small model of Newcomen's engine was sent to him by the Professor of Natural Philosophy, to be repaired, and fitted for exhibition in the class. The examination of this model set Watt upon thinking anew, and with more interest than ever, on the powers of steam.

The first thing that attracted his attention, about the machine before him, the cylinder of which was only of two inches diameter, while the piston descended through six inches, was the insufficiency of the boiler, although proportionably a good deal larger than in the working engines, to supply the requisite quantity of steam for the creation of the vacuum. In order to remedy this defect, he was obliged, in repairing the model, to diminish the column of water to be raised; in other words, to give the piston less to do, in compensation for its having to descend, not through a perfect vacuum, but in opposition to a considerable residue of undisplaced air. He also soon discovered the reason, why, in this instance, the steam sent up from the boiler, was not sufficient to fill

the cylinder. In the first place, this containing vessel, being made, not of cast-iron, as in the larger engines, but of brass, abstracted more of the heat from the steam, and so weakened its expansion; and, secondly, it exposed a much larger surface to the steam, in proportion to its capacity, than the cylinders of the larger engines did, and this operated still more strongly to produce the same effect. Led by the former of these considerations, he made some experiments, in the first instance, with the view of discovering some other material, whereof to form the cylinder of the engine, which should be less objectionable than either brass or cast-iron; and he proposed to substitute wood, soaked in oil, and baked dry. But his speculations soon took a much wider scope; and, struck with the radical imperfections of the atmospheric engine, he began to turn in his mind the possibility of employing steam in mechanics, in some new manner, which should enable it to operate with much more powerful effect. This idea having got possession of him, he engaged in an extensive course of experiments, for the purpose of ascertaining as many facts as possible with regard to the properties of steam; and the pains he took, in this investigation, were rewarded with several valuable discoveries. The rapidity with which water evaporates, he found, for instance, depended simply upon the quantity of heat which was made to enter it; and this, again, on the extent of the surface exposed to the fire. He also ascertained the quantity of coals necessary for the evaporation of any given quantity of water, the heat at which water boils under various pressures, and many other particulars of a similar kind, which had never before been accurately determined.

Thus prepared by a complete knowledge of the properties of the agent with which he had to work, he next proceeded to take into consideration, with a view to their amendment, what he deemed the two grand defects of Newcomen's engine. The first of these, was the necessity arising from the method employed to concentrate the steam, of cooling the cylinder, before every stroke of the piston, by the water injected into it. On this account,

a much more powerful application of heat, than would otherwise have been requisite, was demanded for the purpose of again heating that vessel, when it was to be refilled with steam. In fact, Watt ascertained that there was thus occasioned, in the feeding of the machine, a waste of not less than three fourths of the whole fuel employed. If the cylinder, instead of being thus cooled for every stroke of the piston, could be kept permanently hot, a fourth part of the heat which had been hitherto applied, would be found to be sufficient to produce steam enough to fill it. How, then, was this desideratum to be attained? De Caus had proposed to effect the condensation of the steam by actually removing the furnace from under the boiler before every stroke of the piston; but this, in a working engine, evidently would have been found quite impracticable. Savery, the first who really constructed a working engine, and whose arrangements, as we have already remarked, all showed a very superior ingenuity, employed the method of throwing cold water, over the outside of the vessel containing his steam—a perfectly manageable process, but at the same time a very wasteful one; inasmuch as, every time it was repeated, it cooled not only the steam, but the vessel also, which, therefore, had again to be heated, by a large expenditure of fuel, before the steam could be reproduced. Newcomen's method of injecting the water into the cylinder was a considerable improvement on this; but it was still objectionable on the same ground, though not to the same degree; it still cooled, not only the steam, on which it was desired to produce that effect, but also the cylinder itself, which, as the vessel in which more steam was to be immediately manufactured, it was so important to keep hot. It was also a very serious objection to this last-mentioned plan, that the injected water itself, from the heat of the place into which it was thrown, was very apt to be partly converted into steam; and the more cold water was used, the more considerable did this creation of new steam become. In fact, in the best of Newcomen's engines, the perfection of the vacuum was so greatly impaired, from this cause, that the resistance experi-

enced by the piston in its descent was found to amount to about a fourth part of the whole atmospheric pressure by which it was carried down, or, in other words, the working power of the machine was thereby diminished one fourth.

After reflecting, for some time, upon all this, it at last occurred to Watt to consider whether it might not be possible, instead of continuing to condense the steam in the cylinder, to contrive a method of drawing it off, to undergo that operation in some other vessel. This fortunate idea having presented itself to his thoughts, it was not very long before his ingenuity also suggested to him the means of realizing it. In the course of one or two days, according to his own account, he had all the necessary apparatus arranged in his mind. The plan which he devised, indeed, was an extremely simple one, and, on that account, the more beautiful. He proposed to establish a communication by an open pipe between the cylinder and another vessel, the consequence of which evidently would be, that when the steam was admitted into the former, it would flow into the latter so as to fill it also. If, then, the portion in this latter vessel only, should be subjected to a condensing process, by being brought into contact with cold water, or any other convenient means, what would follow? Why, a vacuum would be produced here; into that, as a vent, more steam would immediately rush from the cylinder; that likewise would be condensed; and so the process would go on till all the steam had left the cylinder, and a perfect vacuum had been effected in that vessel, without so much as a drop of cold water having touched or entered it. The separate vessel alone, or the Condenser, as Watt called it, would be cooled by the water used to condense the steam—and that, instead of being an evil, manifestly tended to promote and quicken the condensation. When Watt reduced these views to the test of experiment, he found the result to answer his most sanguine expectations. The cylinder, although emptied of its steam, for every stroke of the piston as before, was now constantly kept at the same temperature with the steam, (or 212° Fahrenheit's thermometer,) and

the consequence was, that one fourth of the fuel, formerly required, sufficed to feed the engine.

But besides this most important saving in the expense of maintaining the engine, its power was greatly increased, by the more perfect vacuum produced by the new construction, in which, the condensing water, being no longer admitted within the cylinder, could not, as before, create new steam there, while displacing the old. The first method, which Watt adopted, of cooling the steam in the condenser, was to keep that vessel surrounded by cold water; considering it as an objection to the admission of the water into its interior, that it might be difficult in that case to convey it away as fast as it would accumulate. But he found that the condensation was not effected in this manner with so much rapidity as was desirable. It was necessary for him, too, at any rate to employ a pump attached to the condenser, in order to draw off both the small quantity of water deposited by the cooled steam, and the air unavoidably introduced by the same element—either of which, if allowed to accumulate, would have impaired the perfect vacuum necessary to attract the steam from the cylinder. He therefore determined eventually to admit also the additional quantity of water required for the business of condensation, and merely to employ a larger and more powerful pump to carry off the whole.

Such, then, was the remedy by which the genius of this great inventor effectually cured the first and most serious defect of the old apparatus. In carrying his ideas into execution, he encountered, as was to be expected, many difficulties, arising, principally, from the impossibility of realizing theoretical perfection of structure, with such materials as human art is obliged to work with; but his ingenuity and perseverance overcame every obstacle. One of the things which cost him the greatest trouble was, how to fit the piston so exactly to the cylinder, as, without affecting the freedom of its motion, to prevent the passage of the air between the two. In the old engine, this end had been attained by covering the piston with a small quantity of water, the dripping down of which into the space below, where it merely mixed with the stream

introduced to effect the condensation, was of little or no consequence. But, in the new construction, the superiority of which consisted in keeping this receptacle for the steam always both hot and dry, such an effusion of moisture, although only in very small quantities, would have occasioned material inconvenience. The air, alone, besides, which, in the old engine, followed the piston in its descent, acted with considerable effect in cooling the lower part of the cylinder. His attempts to overcome this difficulty, while they succeeded in that object, conducted Watt also to another improvement, which effected the complete removal of what we have called the second radical imperfection of Newcomen's engine, namely, its non-employment, for a moving power, of the expansive force of the steam. The effectual way, it occurred to him, of preventing any air from escaping into the part of the cylinder below the piston, would be, to dispense with the use of that element above the piston, and to substitute there, likewise, the same contrivance as below, of alternate steam and a vacuum. This was, of course, to be accomplished by merely opening communications from the upper part of the cylinder to the boiler on the one hand, and the condenser on the other, and forming it, at the same time, into an air-tight chamber, by means of a cover, with only a hole in it, to admit the rod or shank of the piston, which might, besides, without impeding its freedom of action, be padded with hemp, the more completely to exclude the air. It was so contrived, accordingly, by a proper arrangement of the cocks, and the machinery connected with them, that, while there was a vacuum in one end of the cylinder, there should be an admission of steam into the other; and the steam, so admitted, now served, not only, by its susceptibility of sudden condensation, to create the vacuum, but also, by its expansive force, to impel the piston. Steam, in fact, was now restored to be, what it had been in the early attempts to use it as a mechanical agent, the moving power of the engine; but its efficiency in this capacity was, for the first time, both taken full advantage of, by means of contrivances properly arranged for that end, and combined with,

and aided by, its other equally valuable property, which had alone been called into action in the more recent machines.

These were the great improvements, which Watt introduced, in what may be called the principle of the steam-engine, or, in other words, in the manner of using and applying the steam. They constitute, therefore, the grounds of his claim to be regarded as the true author of the conquest, that has at last been obtained by man, over this powerful element. But original and comprehensive as were the views, out of which these fundamental inventions arose, the exquisite and inexhaustible ingenuity which the engine, as finally perfected by him, displays in every part of its subordinate mechanism, is calculated to strike us, perhaps, with scarcely less admiration. It forms, undoubtedly, the best exemplification that has ever been afforded, of the number and diversity of services which a piece of machinery may be made to render to itself by means, solely, of the various application of its first moving power, when that has once been called into action. Of these contrivances, however, we can only notice one or two, by way of specimen.

Perhaps the most singular is that called the *governor*. This consists of an upright spindle, which is kept constantly turning, by being connected with a certain part of the machinery, and from which two balls are suspended in opposite directions by rods, attached by joints, somewhat in the manner of the legs of a pair of tongs. As long as the motion of the engine is uniform, that of the spindle is so likewise, and the balls continue steadily revolving at the same distance from each other. But as soon as any alteration in the action of the piston takes place, the balls, if it has become more rapid, fly further apart, under the influence of the increased centrifugal force which actuates them, or approach nearer to each other, in the opposite circumstances. This, alone, would have served to indicate the state of matters to the eye; but Watt was not to be so satisfied. He connected the rods with a valve in the tube by which the steam is admitted to the cylinder from the boiler, in such a way, that, as they

retreat from each other, they gradually narrow the opening which is so guarded, or enlarge it as they tend to collapse; thus diminishing the supply of steam when the engine is going too fast, and when it is not going fast enough, enabling it to regain its proper speed, by allowing it an increase of aliment.

Again, the constant supply of a sufficiency of water to the boiler is secured by an equally simple provision, namely, by a *float* resting on the surface of the water, which, as soon as it is carried down by the consumption of the water to a certain point, opens a valve and admits more. And so on, through all the different parts of the apparatus, the various wonders of which cannot be better summed up than in the forcible and graphic language of Dr. Arnott:—"In the present perfect state of the engine, it appears a thing almost endowed with intelligence. It regulates, with perfect accuracy and uniformity, the *number of its strokes* in a given time, *counting* or *recording* them, moreover, to tell how much work it has done, as a clock records the beats of its pendulum; it regulates the *quantity of steam* admitted to work; the *briskness of the fire*; the *supply of water* to the boiler; the *supply of coals* to the fire; it *opens and shuts its valves* with absolute precision as to time and manner; it *oils its joints*; it *takes out any air* which may accidentally enter into parts which should be vacuous; and when any thing goes wrong which it cannot of itself rectify, it *warns its attendants* by ringing a bell; yet, with all these talents and qualities, and even when exerting the power of six hundred horses, it is obedient to the hand of a child; its aliment is coal, wood, charcoal, or other combustibles; it consumes none while idle; it never tires, and wants no sleep; it is not subject to malady when originally well made, and only refuses to work when worn out with age; it is equally active in all climates, and will do work of any kind; it is a water-pumper, a miner, a sailor, a cotton-spinner, a weaver, a blacksmith, a miller, &c. &c.; and a small engine, in the character of a *steam pony*, may be seen dragging after it, on a rail-road, a hundred tons of merchandise, or a regiment of soldiers, with greater speed

than that of our fleetest coaches. It is the king of machines, and a permanent realization of the *Genii* of Eastern fable, whose supernatural powers were occasionally at the command of man."

In addition to those difficulties which his unrivalled mechanical ingenuity enabled him to surmount, Watt, notwithstanding the merit of his inventions, had to contend, for some time, with others of a different nature, in his attempts to reduce them to practice. He had no pecuniary resources of his own, and was at first without any friend, willing to run the risk of the outlay necessary for an experiment, on a sufficiently large scale. At last he applied to Dr. Roebuck, an ingenious and spirited speculator, who had just established the Carron iron-works, not far from Glasgow, and held, also, at this time, a lease of the extensive coal-works at Kinneal, the property of the Duke of Hamilton. Dr. Roebuck agreed to advance the requisite funds, on having two thirds of the profits made over to him; and upon this, Mr. Watt took out his first patent, in the beginning of the year 1769. An engine, with a cylinder of eighteen inches diameter, was soon after erected at Kinneal; and, although, as a first experiment, it was necessarily, in some respects, of defective construction, its working completely demonstrated the great value of Watt's improvements. But Dr. Roebuck, whose undertakings were very numerous and various, in no long time after forming this connexion, found himself involved in such pecuniary difficulties, as to put it out of his power to make any further advances in prosecution of its object. On this, Watt employed himself, for some years, almost entirely in the ordinary work of his profession, as a civil engineer; but, at last, about the year 1774, when all hopes of any further assistance from Dr. Roebuck were at an end, he resolved to close with a proposal which had been made to him, through his friend, Dr. Small, of Birmingham, that he should remove to that town, and enter into partnership with the eminent hardware manufacturer, Mr. Boulton, whose extensive establishments at Soho, had already become famous over Europe, and procured for England an unrivalled reputa-

tion for the arts there carried on. Accordingly, an arrangement having been made with Dr. Roebuck, by which his share of the patent was transferred to Mr. Boulton, the firm of Boulton and Watt commenced the business of making steam-engines, in the year 1775.

Mr. Watt now obtained, from the British Parliament, an extension of his patent for twenty-five years from this date, in consideration of the acknowledged national importance of his inventions. The first thing which he and his partner did, was to erect an engine at Soho, which they invited all persons, interested in such machines, to inspect. They then proposed to erect similar engines, wherever required, on the very liberal principle of receiving, as payment for each, only one third of the saving in fuel which it should effect, as compared with one of the old construction. As this saving, however, had been found to amount, in the whole, to fully three fourths of all the fuel that had been wont to be employed, the revenue, thus accruing to the patentees, became very great, after their engines were extensively adopted. This they very soon were, especially in Cornwall, where the numerous mines afforded a vast field for the employment of the new power, partly in continuing or commencing works which only an economized expenditure could make profitable, and often, also, in labors, which the old engine was altogether inadequate to attempt.

But the draining of mines, was only one of many applications of the steam power, now at his command, which Watt contemplated, and in course of time accomplished. During the whole twenty-five years, indeed, over which his renewed patent extended, the perfecting of his invention was his chief occupation; and, notwithstanding a delicate state of health, and the depressing affliction of severe headaches to which he was extremely subject, he continued, throughout this period, to persevere, with unwearied diligence, in adding new improvements to the mechanism of the engine, and devising the means of applying it to new purposes of usefulness. He devoted, in particular, the exertions of many years, to the contriving of the best methods of making the action of the piston

communicate a rotatory motion in various circumstances; and between the years 1781 and 1785, he took out four different patents, for inventions having this object in view. In the midst of these scientific labors, too, his attention was much distracted by attempts which were made, in several quarters, to pirate his improvements, and the consequent necessity of defending his rights in a series of actions, which, notwithstanding successive verdicts in his favor, did not terminate till the year 1799, when the validity of his claims was finally confirmed, by the unanimous decision of the Judges of the Court of King's Bench.

Watt's inexhaustible ingenuity displayed itself in various other contrivances, beside those which make part of his steam-engine. An apparatus for copying letters and other writings, now in extensive use; a method of heating houses by steam; a new composition, for the purposes of sculpture, having the transparency and nearly the hardness of marble; a machine for multiplying copies of busts and other performances in carving or statuary,—are enumerated among his minor inventions. But it is his steam-engine, that forms the great monument of his genius, and that has conferred upon his name its imperishable renown. This invention has already gone far to revolutionize the whole domain of human industry; and almost every year is adding to its power and its conquests. In our manufactures, our arts, our commerce, our social accommodations, it is constantly achieving what, little more than half a century ago, would have been accounted miracles and impossibilities. "The trunk of an elephant," it has been finely and truly said, "that can pick up a pin, or rend an oak," is as nothing to it. It can engrave a seal, and crush masses of obdurate metal like wax before it; draw out, without breaking, a thread as fine as gossamer; and lift a ship of war, like a bauble, in the air. It can embroider muslin and forge anchors; cut steel into ribands, and impel loaded vessels against the fury of the winds and waves."

And another application of it, which has been made only within the last few years, is perhaps destined to be productive of still greater changes on the condition of so-

ciety, than have resulted from any of its previous achievements. It had been employed, several years ago, at some of our collieries, in the propelling of heavily loaded carriages over rail-ways; but the great experiment of the Liverpool and Manchester Railway, for the first time, practically demonstrated with what hitherto almost undreamt-of *rapidity* travelling by land may hereafter be carried on, through the aid of steam. Coaches, under the impetus communicated by this, the most potent, and at the same time the most perfectly controllable of all our mechanical agencies, have already been drawn forward at the flying speed of thirty and thirty-five miles an hour, and even at a still more rapid rate. If so much has been done already, it would be rash to conclude that even this is to be our ultimate limit of attainment. In navigation, the resistance of the water, which increases rapidly as the force opposed to it increases, very soon sets bounds to the rate at which even the power of steam can impel a vessel forward.* But, on land, the thin medium of the air presents no such insurmountable obstacle to a force making its way through it; and a rapidity of movement may, perhaps, be eventually attained here, which is to us even as yet inconceivable. But even when the rate of land travelling already shown to be quite practicable, shall have become universal, in what a new state of society shall we find ourselves! When we shall be able to travel a hundred miles in any direction in six or eight hours, into what comparative neighborhood will the remotest extremes even of a large country, be brought, and how little shall we think of what we now call distance! A nation will then be, indeed, a community; and all the benefits of the highest civilization, instead of being con-

* [Yet, contrary to the sanguine predictions of many individuals of high intelligence, and the confident calculations of at least one learned man, a new era in navigation has within the past year (1838) commenced, and by means of steam the broad Atlantic may be crossed, with as much greater speed, comparatively speaking, than that of the ordinary mode of ship transportation, as that by rail-road is greater than by the customary land conveyance. It is vain and idle to attempt to set limits to man's ingenuity, or to circumscribe the results that may flow therefrom.—Am. Pub.]

fined to one central spot, will be diffused equally over the land, like the light of heaven. This improvement, in short, when fully consummated, will confer upon man nearly as much new power and new enjoyment, as if he were actually endowed with wings.

It is gratifying to reflect, that, even while he was yet alive, Watt received, from the voice of the most illustrious of his contemporaries, the honors due to his genius. In 1785, he was elected a Fellow of the Royal Society; the degree of Doctor of Laws was conferred upon him by the University of Glasgow in 1806; and in 1808, he was elected a member of the French Institute. He died on the 25th of August, 1819, in the 84th year of his age.

We cannot better conclude our sketch of the life of this great inventor, than by the following extract from the character that has been drawn of him by the eloquent writer (Mr. Jeffrey) whom we have already quoted. "Independently of his great attainments in mechanics, Mr. Watt was an extraordinary, and, in many respects, a wonderful man. Perhaps no individual, in his age, possessed so much and such varied and exact information; had read so much, or remembered what he had read so accurately and well. He had infinite quickness of apprehension, a prodigious memory, and a certain rectifying and methodizing power of understanding, which extracted something precious out of all that was presented to it. His stores of miscellaneous knowledge were immense, and yet less astonishing than the command he had at all times over them. It seemed as if every subject, that was casually started in conversation, had been that which he had been last occupied in studying and exhausting; such were the copiousness, the precision, and the admirable clearness of the information which he poured out upon it without effort or hesitation. Nor was this promptitude and compass of knowledge confined, in any degree, to the studies connected with his ordinary pursuits. That he should have been minutely and extensively skilled in chemistry and the arts, and in most of the branches of physical science, might perhaps have been conjectured; but it could not have been inferred, from his usual occupations, and

probably is not generally known, that he was curiously learned in many branches of antiquity, metaphysics, medicine, and etymology, and perfectly at home in all the details of architecture, music, and law. He was well acquainted, too, with most of the modern languages, and familiar with their most recent literature. Nor was it at all extraordinary to hear the great mechanician and engineer detailing and expounding, for hours together, the metaphysical theories of the German logicians, or criticizing the measures or the matter of the German poetry.

"His astonishing memory was aided, no doubt, in a great measure, by a still higher and rarer faculty—by his power of digesting and arranging, in its proper place, all the information he received, and of casting aside and rejecting, as it were instinctively, whatever was worthless or immaterial. Every conception, that was suggested to his mind, seemed instantly to take its place among its other rich furniture, and to be condensed into the smallest and most convenient form. He never appeared, therefore, to be at all encumbered or perplexed with the *verbiage* of the dull books he perused, or the idle talk to which he listened; but to have at once extracted, by a kind of intellectual alchymy, all that was worthy of attention, and to have reduced it, for his own use, to its true value and to its simplest form. And thus it often happened, that a great deal more was learned from his brief and vigorous account of the theories and arguments of tedious writers, than an ordinary student could ever have derived from the most faithful study of the originals; and that errors and absurdities became manifest, from the mere clearness and plainness of his statement of them, which might have deluded and perplexed most of his hearers, without that invaluable assistance."

CHAPTER XIII.

Sir Richard Arkwright:—The Cotton Manufacture.

We propose now to give some account of an individual, whose rise, from a very humble origin, to affluence and distinction, was the result of his persevering attention to the improvement of the machinery employed in one of the most important branches of our manufactures, and whose name is intimately connected with the recent history of the commercial greatness of his country. We allude to the celebrated Sir Richard Arkwright. Arkwright was born on the 23d of December, 1732, at Preston, in Lancashire. His parents were very poor, and he was the youngest of a family of thirteen children; so that we may suppose the school education he received, if he ever was at school at all, was extremely limited. Indeed, but little learning would probably be deemed necessary for the profession to which he was bred,—that of a barber. This business he continued to follow till he was nearly thirty years of age; and this first period of his history is of course obscure enough. About the year 1760, however, or soon after, he gave up shaving, and commenced business as an itinerant dealer in hair, collecting the commodity by travelling up and down the country, and then, after he had dressed it, selling it again to the wig-makers, with whom he very soon acquired the character of keeping a better article than any of his rivals in the same trade. He had obtained possession, too, we are told, of a secret method of dyeing the hair, by which he doubtless contrived to augment his profits; and perhaps, in his accidental acquaintance with this little piece of chemistry, we may find the germ of that sensibility he soon began to manifest, to the value of new and unpublished inventions

in the arts, and of his passion for patent-rights and the pleasures of monopoly.

It would appear, that his first effort in mechanics, as has happened in the case of many other ingenious men, was an attempt to discover the perpetual motion. It was in inquiring after a person to make him some wheels for a project of this kind, that, in the latter part of the year 1767, he got acquainted with a clockmaker, of the name of Kay, then residing at Warrington, with whom it is certain that he remained, for a considerable time after, closely connected. From this moment, we may date his entrance upon a new career.

The manufacture of cotton cloths was introduced into England only towards the end of the seventeenth century; although stuffs, improperly called Manchester cottons, had been fabricated nearly three centuries before, which, however, were made entirely of wool. It is generally thought, that the first attempt at the manufacture of cotton goods in Europe, did not take place till the end of the fifteenth century, when the art was introduced into Italy. Before this, the only cottons known, had been imported from the East Indies.

The English cottons, for many years after the introduction of the manufacture, had only the weft of cotton; the warp, or longitudinal threads of the cloth, being of linen. It was conceived to be impracticable to spin the cotton with a sufficiently hard twist, to make it serviceable for this latter purpose. Although occasionally exported too in small quantities, the manufactured goods were chiefly consumed at home. It was not till about the year 1760, that any considerable demand for them arose abroad.

But about this time, the exportation of cottons, both to the European continent and to America, began to be carried on on a larger scale, and the manufacture of course received a corresponding impulse. The thread had hitherto been spun entirely, as it still continues to be in India, by the tedious process of the distaff and spindle, the spinner drawing out only a single thread at a time. But as the demand for the manufactured article continued to increase, a greater and greater scarcity of weft was expe-

rienced, till, at last, although there were 50,000 spindles constantly at work in Lancashire alone, each occupying an individual spinner, they were found quite insufficient to supply the quantity of thread required. The weavers generally, in those days, had the weft they used, spun for them by the females of their family; and now "those weavers," says Mr. Guest, in his 'History of the Cotton Manufacture,' "whose families could not furnish the necessary supply of weft, had their spinning done by their neighbors, and were obliged to pay more for the spinning than the price allowed by their masters; and even with this disadvantage, very few could procure weft enough to keep themselves constantly employed. It was no uncommon thing for a weaver to walk three or four miles in a morning, and call on five or six spinners, before he could collect weft to serve him for the remainder of the day; and when he wished to weave a piece in a shorter time than usual, a new riband, or gown, was necessary to quicken the exertions of the spinner."

It was natural, in this state of things, that attempts should be made, to contrive some method of spinning, more effective than that which had hitherto been in use; and, in fact, several ingenious individuals seem to have turned their attention to the subject. Long before this time, indeed, spinning by machinery had been thought of by more than one speculator. A Mr. Wyatt, of Litchfield, is stated to have actually invented an apparatus for that purpose, so early as the year 1733, and to have had factories built and filled with his machines, both at Birmingham and Northampton. These undertakings, however, not being successful, the machines were allowed to perish, and no model or description of them was preserved. There was also a Mr. Laurence Earnshaw, of Mottram, in Cheshire, of whom "it is recorded," says Mr. Baines, in his 'History of Lancashire,' "that, in the year 1753, he invented a machine to spin and reel cotton at one operation, which he showed to his neighbors, and then destroyed it, through the generous apprehension that he might deprive the poor of bread"—a mistake, but a benevolent one.

It was in the year 1767, as we have mentioned, that Arkwright became acquainted with Kay. In 1768, the two friends appeared together at Preston, and immediately began to occupy themselves busily in the erection of a machine for the spinning of cotton-thread, of which they had brought a model with them. They had prevailed upon a Mr. Smalley, who is described to have been a liquor merchant and painter of that place, to join them in their speculation; and the room in which the machine was fixed was the parlor of the dwelling-house, attached to the free grammar-school, the use of which Smalley had obtained from his friend, the schoolmaster. At this time, Arkwright was so poor, that, an election contest having taken place in the town, of which he was a burgess, it is asserted that his friends, or party, were obliged to subscribe, to get him a decent suit of clothes, before they could bring him into the poll-room.* As soon as the election was over, he and Kay left Preston, and, carrying with them their model, betook themselves to Nottingham, the apprehension of the hostility of the people of Lancashire to the attempt he was making, to introduce spinning by machinery, having, as Arkwright himself afterwards stated, induced him to take this step. On arriving at Nottingham, he first made arrangements with Messrs. Wrights, the bankers, for obtaining the necessary supply of capital; but they, after a short time, having declined to continue their advances, he took his model to Messrs. Need and Strutt, stocking weavers of that place, the latter of whom was a particularly ingenious man, and well qualified, from his scientific acquirements, of which he had possessed himself under many disadvantages, to judge of the adaptation of the new machinery to its proposed object. An inspection of it perfectly satisfied him of its great value; and he and Mr. Need immediately agreed to enter into partnership with Arkwright, who, accordingly, in 1769, took out a patent for the machine as its inventor. A spinning-mill, driven by horse power, was at the same time erected, and filled with the frames;

* Baines's History of Lancashire, vol. ii. p. 484.

being, unless we include those erected many years before by Mr. Wyatt, the first work of the kind, that had been known in England. In 1771, Arkwright and his partners established another mill at Cromford, in the parish of Wirksworth, in Derbyshire, the machinery in which was set in motion by a water-wheel; and in 1775, he took out a second patent, including some additions which he had made to his original apparatus.

In what we have hitherto related, we have carefully confined ourselves to facts, which are universally acknowledged; but there are other points of the story that have been stated in very opposite ways, and have given rise to much doubt and dispute.

The machinery, for which Arkwright took out his patents, consisted of various parts, his second specification enumerating no fewer than ten different contrivances; but of these, the one that was by far of the greatest importance, was a device for drawing out the cotton from a coarse to a finer and harder twisted thread, and so rendering it fit to be used for warp as well as weft.* This was most ingeniously managed, by the application of a principle, which had not yet been introduced in any other mechanical operation. The cotton was in the first place, drawn off from the skewers on which it was fixed, by one pair of rollers, which were made to move at a comparatively slow rate, and which formed it into threads of the first and coarser quality,† but at a little distance behind the first, was placed a second pair of rollers, revolving three, four, or five times as fast, which took it up when it had passed through the others, the effect of which would be to reduce the thread to a degree of fineness so many times greater than that which it originally had. The

* This was, in truth, the principal subject of Arkwright's first patent; and, accordingly, on the great trial, (afterwards mentioned,) which took place in June, 1785, his opponents accused him of endeavoring unfairly to prolong his first patent by means of his second.

† In Arkwright's apparatus, which was a combination of the carding and spinning machinery, this first part of the process was somewhat modified; but the principle of the two pairs of rollers, the one revolving faster than the other, which forms the peculiarity of the machine, was employed as here described.

first pair of rollers might be regarded as the feeders of the second, which could receive no more than the others sent to them; and that, again, could be no more than these others themselves took up from the skewers. As the second pair of rollers, therefore, revolved, we will say, five times for every one revolution of the first pair, or, which is the same thing, required for their consumption, in a given time, five times the length of thread that the first did, they could obviously only obtain so much length by drawing out the common portion of cotton into thread, of five times the original fineness. Nothing could be more beautiful or more effective than this contrivance; which, with an additional provision for giving the proper twist to the thread, constitutes what is called the water-frame or throstle.*

Of this part of his machinery, Arkwright particularly claimed the invention, as his own. He admitted, with regard to some of the other machines, included in his patent, that he was rather their improver than their inventor: and the original spinning-machine, for coarse thread, commonly called the spinning-jenny, he frankly attributed, in its first conception, to a person of the name of Hargrave, who resided at Blackburn, and who, he said, having been driven out of Lancashire in consequence of his invention, had taken refuge in Nottingham; but, unable to bear up against a conspiracy formed to ruin him, had been at last obliged to relinquish the further prosecution of his object, and died in obscurity and distress.

There were, however, other parties, who had an interest as well as Arkwright in these new machines, and who would not allow that any of them were of his invention. As to the principal of them, the water-frame, they alleged that it was in reality the invention of a poor reed-maker, of the name of Highs, or Hayes, and that Arkwright had obtained the knowledge of it, from his old associate, Kay, who had been employed by Highs, to assist him in constructing a model of it, a short time before Arkwright had sought his acquaintance. Many cotton-spinners, profes-

* So called from its having been originally moved by *water* power.

sing to believe this to be the true state of the case, actually used Arkwright's machinery in their factories, notwithstanding the patent by which he had attempted to protect it; and this invasion of his monopoly was carried to such an extent, that at last he found himself obliged to bring actions against no fewer than nine different parties.*

The first of these, in which a Colonel Mordaunt was defendant, was tried in the Court of King's Bench, in July, 1781. Upon this occasion, however, the question as to the originality of the invention was not mooted; the defence taken, being the insufficiency of the specification on which the patent had been obtained; and upon that ground a verdict was given in favor of the defendant. On this result, Arkwright abandoned the other eight actions he had raised; and instead of attempting any longer to maintain his patent in a court of law, published a pamphlet, containing what he called his 'Case,' with a view of inducing the legislature to interfere for his protection. It is proper we should here mention that, although the first of these actions, in 1781, which decided the fate of the others, thus went off without the real merits of the case having been gone into, yet several of the defendants were prepared to dispute the claim of the patentee to the invention of the machines, and that both Highs and Kay had been summoned to give their evidence upon that point, and were actually in court during the trial of the action against Colonel Mordaunt, the former having been

* It is asserted, in the article on the cotton manufacture, in the Supplement to the Encyclopedia Britannica, and repeated in a paper on the same subject in the ninety-first number of the Edinburgh Review, that a trial took place upon the subject of Arkwright's first patent, in the year 1772, on which occasion he obtained a verdict establishing its validity. This statement, however, for which no authority is given, appears to be altogether without foundation. No such trial is alluded to, in the course of the proceedings in the Court of King's Bench, in June and November, 1785, although both that of July, 1781, and that of February, 1785, are repeatedly mentioned; nor is it noticed, we believe, in any of the earlier accounts of Arkwright's machinery. Mr. Guest, (who has written a history of the cotton manufacture, which is marked by a somewhat strong dislike to Arkwright,) searched the records of the courts of King's Bench, Common Pleas, and Exchequer, for the year 1772, without finding any trace of it.

brought over from Ireland, where he was then residing, expressly for the occasion.

Arkwright submitted to the verdict that had been given against him for nearly four years; but at last, in February, 1785, he commenced a second action upon the subject, which was tried in the Court of Common Pleas; and, having brought forward several artists, who declared that they could make the machines, from the descriptions which he had given in his specification, he obtained a verdict, which reinstated him in the enjoyment of his monopoly. Upon this, as on the former occasion, the only question submitted to the jury, was that regarding the sufficiency of the specification; although it soon appeared, that several of the parties interested, were determined not to rest satisfied with a decision of the matter, upon that ground alone.

Accordingly, in the month of June, in the same year, a *scire-facias*,* an action which is nominally at the suit of the King, was brought against Arkwright, in the Court of King's Bench, to repeal the patent, in the trial of which, the whole of the question was at last gone into. The principal evidence, on which it was attempted to be shown that the water-frame was not invented by Arkwright, was that of Highs, of Kay, and of Kay's wife, the substance of which was, that the double rollers had been originally contrived by Highs, in the early part of the year 1767, while he was residing in the town of Leigh; that he had employed his neighbor and acquaintance, Kay, to make a model of a machine for him upon that principle; and that Kay, upon meeting with Arkwright, a short time after, at Warrington, had been persuaded by him, to communicate to him the secret of Highs's invention, on the understanding, as it would appear, that the two should make what they could of it, and share the advantages between them. The evidence of each of the witnesses corroborated, so far as the case

* [" Cause it to be known ;" the name of a writ generally used for the purpose of calling the defendant to show cause why execution should not be made out against him on a judgement which has been given.]

admitted, that of the others; Highs stating that he had been first informed of the manner in which Arkwright had got possession of his invention, by Kay's wife, who, on her part, swore that she recollected her husband making models, first for Highs, and afterwards for Arkwright, although she could not speak with any distinctness to the nature of the machine; while Kay, himself, acknowledged the treachery of which he had been guilty, and gave a particular account of the manner in which he said that Arkwright had contrived to obtain from him the secret of Highs's invention. Highs also stated, that, upon meeting with Arkwright, in Manchester, some years after he had taken out his patent, he charged him with the source from which he had derived the machine; to which Arkwright said nothing at first, but afterwards remarked, that, if any person, having made a discovery, declined to prosecute it, he conceived any other had a right, after a certain time, to take it up and obtain a patent for it, if he chose.

This famous trial lasted from nine o'clock in the morning, till half-past twelve at night, and excited the greatest interest, both among those more immediately concerned, and among the public generally. Among the witnesses examined, were Mr. Cumming, the wellknown watchmaker, Mr. Harrison, the son of the inventor of the marine chronometer, Dr. Darwin, and the afterwards celebrated James Watt.* The result was, a verdict again invalidating the patent; which, on a motion being made for a new trial, the court refused to disturb. Arkwright, after this, never took any further steps to vindicate his patent rights. On this account, some writers have been disposed to maintain, that he really had obtained the inventions in the manner that Highs and Kay alleged. It is, however, to be remembered, that it has been a common fate, with those who have been fortunate enough to enrich themselves, by their happy inventions, to have attempts made to take from them the honor of those discoveries, of the profits of which it is found im-

* A sketch of whose life has been given in the preceding chapter.

possible to deprive them;—and that it has seldom, in such cases, been difficult to find some hitherto unheard-of genius, to set up his claim to the prior discovery of what, nevertheless, it would appear he scarcely knew the value of, after he had discovered it.

In this particular case, the other party had a strong interest in setting aside Arkwright's pretensions, if they could, and the circumstance of Kay having been connected with Highs, before he was employed by him, afforded them a tempting foundation, on which to erect what they, no doubt, considered a very convenient theory. Then, again, as for so much of their allegation as rested upon the evidence of this Kay, it was not entitled to command much attention, since it appeared both that he had sometime before quarrelled with Arkwright, and that he must, even by his own account, have acted so perfidious a part in regard to his first friend, Highs, as to deprive him of all claim to be believed, in any thing he might now choose to assert. Highs's own evidence is, undoubtedly, what seems to bear strongest against Arkwright; but he, from very natural causes, might have been mistaken as to various points. He appears to have told his story in a very confused and ineffective way, much as if he either did not feel his ground to be very sure, or was not at all aware of the importance of the facts to which he was brought to speak. It is not impossible, that, if he actually did invent the machine in question, Arkwright may have also hit upon the same idea, about the same time; or may, at least, have been led to it merely by some vague rumor that had got abroad, as to what Highs was about—not an unnatural supposition, when we reflect that his operations seem to have been a good deal talked of, in the neighborhood, and that the slightest hint of the principle of the water-frame, would have sufficed to put an ingenious man, like Arkwright, in possession of the whole machine. And this, after all, gives us, perhaps, the most natural explanation of his conversation with Highs at Manchester. If he knew that he had really stolen his invention from that person, in the manner stated in Kay's evidence, it is not likely that he would have

been much disposed to meet him at all; whereas the interview appears to have been arranged by the intervention of a mutual acquaintance, who had, in all probability, obtained the consent of both parties to his bringing them together. His silence, when Highs charged him with having got possession of his invention, or rather merely noticed the circumstance, (for the whole seems to have passed in quite an amicable manner,) will depend, for its interpretation, very much upon the exact words used by Highs, which it is very possible he did not recollect, perfectly, when he gave his evidence in the Court of King's Bench, twelve or thirteen years afterwards. Perhaps he said nothing about Kay at all; but merely remarked, in general terms, that he had been beforehand with Mr. Arkwright, in thinking of the two pairs of rollers, which formed so valuable a part of his patent machinery. This was an averment which, for any thing that Arkwright knew, might be true, and which, if incorrect, he had at any rate no means of refuting;—so that nothing could be more natural than his remaining silent, although he would scarcely, one should think, have taken the thing quite so passively, if he had been flatly charged with the base conduct, afterwards imputed to him.

The observation, again, he is said to have made a little while after, is perfectly consistent with this view of the case. He waives the question, as to which of the two might have been first in possession of the idea; and contents himself with simply remarking, that, however that might be, he conceived any one who had made a discovery which he thought might be turned to advantage was quite entitled to take it up and prosecute it, by himself, even though another might also be in possession of it, if that other showed no intention of stirring in the business. And to this remark, Highs, by his own account, quietly assented, although it certainly would have been natural enough for him to have hinted, if he really had previously advanced the charge, which, on the trial, he said he had done, that whatever a man might do with regard to an invention that was really his own, he could

hardly have a right, in any circumstances, to steal those of other people, and take out a patent for them.

Whatever conclusion may be come to on the subject of Arkwright's claim to the invention of the machinery introduced by him into his spinning factories, it is incontestable, that to him, alone, belongs the merit, both of having combined its different parts, with admirable ingenuity and judgement, and of having, by his unwearied and invincible perseverance, first brought it into actual use, on any thing like an extensive scale, and demonstrated its power and value. The several inventions, which his patent embraced, whether they were his own, or not, would probably, but for him, have perished with their authors; none of whom, except himself, had the determination and courage to face the multiplied fatigues and dangers, that lay in the way of achieving a practical exemplification of what they had conceived in their minds, or to encounter any part of that opposition, incredulity, ridicule, of those disappointments, repulses, losses, and other discouragements, over all of which he at last so completely triumphed. When he set out on this career, he was poor, friendless, and utterly unknown. We have already stated, that, on his coming with Kay to Preston, he was almost in rags; and it may be added, that when he and Kay made application, immediately before this, to a Mr. Atherton, for some pecuniary assistance, to enable them to prosecute their plans, Arkwright's appearance, alone, was enough to determine that gentleman to have nothing to do with the adventure.

Can we have a more exciting example, then, of what a resolute heart may do, in apparently the most hopeless circumstances?—of what ingenuity and perseverance, together, may overcome, in the pursuit of what they are determined to attain? And this is the grand lesson, which the history of Arkwright is fitted to teach us,—to give ourselves wholly to one object, and never to despair of reaching it. Even after he had succeeded in forming his partnership with Messrs. Need and Strutt, his success was far from being secured. For a long time, the speculation was a hazardous and unprofitable one; and no little

outlay of capital was required to carry it on. He tells us, himself, in his 'Case,' that it did not begin to pay, till it had been persevered in for five years, and had swallowed up a capital of more than twelve thousand pounds. We cannot doubt, that it required all Arkwright's dexterity and firmness to induce his partners to persevere with the experiment, under this large expenditure and protracted disappointment. But it was the character of the man to devote his whole heart and faculties to whatever he engaged in. Even to the close of his life, the management of his different factories was his only occupation, and even amusement. Although he had been from early life afflicted with severe asthma, he took scarcely any recreation; employing all his time either in superintending the daily concerns of these establishments, which were regulated upon a plan that itself indicated in its contriver no little ingenuity and reach of mind;* or in adding such improvements to his machinery, from time to time, as his experience and observation suggested. And thus it was, that from a poor barber, he raised himself to what he eventually became,—not merely to rank and great affluence,—but to be the founder of a new branch of national industry, destined, in a wonderfully short space of time, to assume the very first place among the manufactures of his country. A very short review of what the cotton trade now is, as compared with its former state, will show what it owes to Sir Richard Arkwright.

England may be said to have been a manufacturing country, for five hundred years, from the time, namely, when the clothiers of Flanders came over, in great num-

* "The originality and comprehension of Sir Richard Arkwright's mind," says the writer of the article on the cotton manufacture, in the Supplement to the 'Encyclopedia Britannica,' "were, perhaps, marked by nothing more strongly, than the judgement with which, although new to business, he conducted the great concerns his discoveries gave rise to, and the systematic order and arrangement which he introduced into every department of his extensive works. His plans of management, which must have been entirely his own, since no establishment of a similar nature then existed, were universally adopted by others; and after long experience, they have not yet in any material point been altered or improved."

bers, and settled themselves in different parts of the kingdom, on the marriage of Edward III., to Philippa of Hainault. The manufacture of cotton cloth, however, as we have already noticed, was not introduced, till about the middle of the seventeenth century, and made no extraordinary progress, for a hundred years afterwards. As an evidence of the comparatively slight degree of interest which it excited, and of the little ingenuity which was consequently exerted in its improvement, it may be stated that the valuable invention of the fly-shuttle, which was introduced into the woollen manufacture, about the year 1738, was not employed in the weaving of cottons till more than twenty years afterwards; up to which period, whenever the web was more than three feet wide, two men were constantly stationed at the loom in which it was wrought, the one to throw the shuttle from right to left, and the other to throw it back, from left to right. It was not till the year 1769, that an attempt was made upon any considerable scale to spin cotton thread by machinery; for, whatever may have been done, before this time, by individuals of mechanical ingenuity, in inventing contrivances for that purpose, it is certain that the invaluable improvement in question, was really introduced into the manufacture, by Arkwright, when he took out his patent and built his first mill.

The revolution, therefore, we may almost say, in the whole aspect and character of manufacturing and commercial interests, which has hence arisen, is the work of only the last sixty years. About the beginning of the last century, the quantity of raw cotton, annually imported into Great Britain, did not amount to 1,200,000lbs.; and by the year 1720, it had not increased to much beyond 2,000,000lbs. There are no returns from 1720 to 1771; but the importation had probably gone on increasing, during that interval, although at a slow rate. Nor did it make a very rapid progress, even for several years after spinning by machinery was introduced, having from 1771 to 1775, averaged only 4,764,589lbs., and for the next five years, only 6,706,013lbs. In 1784, the year immediately preceding the final repeal of Arkwright's

patent, it amounted to 11,482,083lbs. That event gave a great impulse to the manufacture, the average importation for the next five years having grown to 25,443,270lbs. annually. In 1799, it had risen to 43,379,278lbs., and in 1800, to 56,010,732lbs. In 1817 it was 124,912,968lbs., and in 1825 it actually amounted to the immense quantity of 228,005,291lbs. The average importation of raw cotton, into Great Britain, may now be stated, as considerably exceeding 200,000,000 of pounds per annum, or as amounting to fully a hundred times what it was a century ago, and to more than fifty times what it was when Arkwright began to spin.

The whole of this raw material, with the exception of about ten millions of pounds, which are used in an unmanufactured state, and from ten to twenty millions which are annually exported, is spun into thread, and mostly wrought into cloth, in the country. The Rev. Dr. Cartwright invented his power-loom, in 1784; but it is only since the commencement of the present century, that weaving by machinery has become general. Steam was first applied as the moving power, for the spinning machinery, in 1785; in which year, Messrs. Boulton and Watt erected one of their rotative engines for a factory belonging to the Messrs. Robinsons, at Papplewich, in Nottinghamshire. In the present day, the cotton is carded, spun, and woven into cloth, in the same manufactory; these different operations being performed by machinery, the several parts of which are all set in motion by a single steam-engine.

In 1787, the number of spinning factories, in the county of Lancaster, amounted only to 42, of comparatively inconsiderable magnitude; in August, 1825, there were, according to Mr. Baines,* no fewer than 104 such factories in Manchester, alone, which were worked by 110 steam-engines, of the aggregate power of 3,598 horses. The number of steam-looms now at work in the kingdom is calculated at 45,000,† of which about 8,000 are in Scotland, and above 20,000 in Manchester. In 1824, it

* History of Lancashire, vol. ii. p. 134.

† Edinburgh Review, No. 91.

has been stated* that the number of spindles, constantly in motion, was about six millions, and the power by which they were moved, equal to that of 10,572 horses. In another statement, however, drawn up by Mr. Kennedy,† it is calculated, that in 1817, (when the importation of raw cotton was not nearly so great as in 1824,) the number of spindles was 6,645,833, and the moving power equal to that of 20,768 horses. Some idea may be formed of the growth of this manufacture, since the year 1769, by contrasting the astonishing number of threads which it would thus appear are spun every day now, with the 50,000 which were all that were produced then.

The produce of all this machinery, is, as may be supposed, immense. "In the present improved state of this, (the weaving,) process," says the writer of the article already referred to in the 'Encyclopedia Britannica,' "one person, generally a girl, attends to two looms, the weekly produce of which is from seven to nine pieces of cloth, of seven-eighths wide, and twenty-eight yards long." "A single factory, in Manchester," says Mr. Guest, writing in 1828, "and that not of first rate magnitude, receives the raw cotton, and turns out a web of cloth, varying in width from three quarters of a yard to a yard and a quarter, of forty miles in length, every week." In 1750, it has been calculated, that the whole amount of the cotton manufacture of the kingdom did not exceed the annual value of £200,000; it is now considered, on good grounds, to amount to fully thirty-six millions of pounds sterling, per annum.‡ Sir Richard Arkwright states, in his 'Case,' published in 1781, that the capital then invested in buildings and machinery, by those engaged in this trade, amounted to £200,000; it is calculated to amount, now, in Lancashire alone, which possesses about four fifths of the trade, to £8,000,000.§ In the year ending on the 1st of May, 1818, 105,000,000 of yards of cotton cloth,

* Supp. to Encyc. Brit., art. Cotton Manufacture.

† Manchester Memoirs, Second Series, vol. iii.

‡ Edin. Review, No. 91.

§ Baines's Lancashire, vol. ii. p. 184.

of all sorts, were manufactured in Glasgow, and the neighborhood, of which the value was about £5,200,000.* Of this, about one half was exported. The value of the cotton cloths, twist, and yarn, exported from Great Britain, for some years past, has been on an average about £16,000,000, leaving, of course, about £20,000,000 worth, for home consumption. The export trade in cotton, is now fully three times that in woollens, the manufacture of which, used to be the great staple of the kingdom.

The extraordinary perfection, to which every part of the cotton manufacture has now been carried, is another result, for which we are entirely indebted to the introduction of machinery. Especially since the invention of the mule, a compound of the jenny and the water-frame, about the year 1790, the muslins manufactured in England have been every year attaining a greater fineness of fabric, and are now rapidly approaching to a rivalry, even in this respect, with the most exquisite productions of the East. As an illustration of the state of advancement, to which the spinning process has been brought, it may be mentioned, that "Mr. John Pollard, of Manchester, spun, in 1792, on the mule, no fewer than 278 hanks of yarn, forming a thread of 233,520 yards, or upwards of 132 miles in length, from a single pound of raw cotton."† The diminution in the price of the manufactured article, which has been produced by the successive improvements in the cotton machinery, is equally extraordinary. Yarn of what is called No. 100, which, even in 1786, after its price had been greatly reduced, by the cancelling of Arkwright's patent, sold for thirty-eight shillings sterling, has fallen in price, every year since that time, and is now to be had for three or four shillings sterling.‡ The raw material is now, indeed, brought from India, and manufactured into cloths in England, which, after being reexported to that country, are actually sold there cheaper

* Encyc. Brit. Supp. vol. iii. p. 404.

† Edinburgh Review, No. 91, p.15.

‡ Encyc. Brit. Supp. vol. iii. p. 398.

than the produce of the native looms. There can hardly be a more striking proof than this, of the triumph of machinery.

Finally, it has been calculated, that, while the number of persons employed in the cotton manufacture, in 1767, did not probably amount to 30,000, the number of those now engaged in its different departments can hardly be less than a million.* Yet, "in some branches of the business," it has been stated, "the spinning, in particular, such is the economy of labor introduced by the use of machinery, that one man and four children will spin as much yarn, as was spun by six hundred women and girls fifty years ago."†

CHAPTER XIV.

Invention of the Power-Loom:—Dr. Cartwright. William Edwards,—Notice of Bridges. Robert Walker.

MACHINERY, in addition to being used in the spinning, is now, as we noticed in our last chapter, extensively applied to the weaving, of cotton; and we now propose to give a short account of the Rev. Dr. CARTWRIGHT, to whose ingenuity this great national manufacture is indebted for the introduction of its crowning improvement. We have been supplied with the materials of the following sketch from a quarter which enables us to supply some original and authentic information.

Edmund Cartwright was born in the year 1743, and was the fourth son of William Cartwright, Esq., of Marnham, in Nottinghamshire. One of his elder brothers was the late Major John Cartwright, so well known for his steady devotion through a long life to what he believed to

* Edinburgh Review, No. 91.

† Baines's Lancashire, vol. i. p. 119.

be the cause of truth and patriotism, and for many public and private virtues which commanded the respect even of those who differed most widely from him in politics. Being intended for the Church, Edmund, at the usual age, was entered of University College, Oxford, whence he was subsequently elected a Fellow of Magdalen College. He early distinguished himself, by his literary attainments, an evidence of which he gave to the world, while yet a young man, by the publication of a small volume of Poems, which was very favorably received. About the year 1774, also, he became a contributor to the Monthly Review; for which he continued to write, during the following ten years.

For the first forty years of his life, he had never given any attention to the subject of mechanics; although, as was recollected long afterwards, his genius for invention, in that department, had once displayed itself, while at his father's house, during one of his college vacations, in some improvements which he made on an agricultural machine which happened to attract his notice. But this exercise of his ingenuity, being out of the line of his pursuits at that time, led to no other attempts of the kind, nor to any further application of his thoughts to such matters.

The circumstances, which, many years after this, led him to the invention of his weaving machine, or power-loom, as it is commonly called, cannot be better described than they have been by himself in the following statement, —first printed in the Supplement to the Encyclopedia Britannica. "Happening," he says, "to be at Matlock, in the summer of 1784, I fell in company with some gentlemen of Manchester, when the conversation turned on Arkwright's spinning-machinery. One of the company observed, that as soon as Arkwright's patent expired, so many mills would be erected, and so much cotton spun, that hands would never be found to weave it. To this observation, I replied, that Arkwright must then set his wits to work to invent a weaving-mill. This brought on a conversation upon the subject, in which the Manchester gentlemen unanimously agreed that the thing was impracticable; and in defence of their opinion, they ad

duced arguments which I was certainly incompetent to answer, or even to comprehend, being totally ignorant of the subject, having never, at the time, seen a person weave. I controverted, however, the impracticability of the thing by remarking that there had been lately exhibited in London, an automaton figure, which played at chess. Now you will not assert, gentlemen, said I, that it is more difficult to construct a machine that shall weave, than one that shall make all the variety of moves that are required in that complicated game.

Some time afterwards, a particular circumstance recalling this conversation to my mind, it struck me that, as in plain weaving, according to the conception I then had of the business, there could be only three movements, which were to follow each other in succession, there could be little difficulty in producing and repeating them. Full of these ideas, I immediately employed a carpenter and smith to carry them into effect. As soon as the machine was finished, I got a weaver to put in the warp, which was of such materials as sailcloth is usually made of. To my great delight, a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to mechanism, either in theory or practice, nor had seen a loom at work, nor knew any thing of its construction, you will readily suppose that my first loom must have been a most rude piece of machinery. The warp was laid perpendicularly; the reed fell with a force of at least half a hundred weight, and the springs which threw the shuttle were strong enough to have thrown a congreve rocket. In short, it required the strength of two powerful men to work the machine, at a slow rate, and only for a short time. Conceiving, in my simplicity, that I had accomplished all that was required, I then secured what I thought a most valuable property, by a patent, 4th of April, 1785. This being done, I then condescended to see how other people wove; and you will guess my astonishment, when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw, I made a loom, in its general principles nearly as they are now made. But it was not

till the year 1787, that I completed my invention, when I took out my last weaving patent, August the 1st, of that year."

Dr. Cartwright's children still remember often seeing their father, about this time, walking to and fro, apparently in deep meditation, and occasionally throwing his arms from side to side; on which they used to be told, that he was thinking of weaving and throwing the shuttle. From the moment, indeed, when his attention was first turned to the invention of the power-loom, mechanical contrivance became the grand occupying subject of his thoughts. With that sanguineness of disposition, which seems to be almost a necessary part of the character of an inventor, he looked upon difficulties, when he met with them, in any of his attempts, as only affording his genius an occasion for a more distinguished triumph; nor did he allow even repeated failures, for a moment to dishearten him. Some time after he had brought his first loom to perfection, a manufacturer, who had called upon him to see it at work, after expressing his admiration of the ingenuity displayed in it, remarked that, wonderful as was Mr. Cartwright's mechanical skill, there was one thing that would effectually baffle him, the weaving, namely, of patterns in checks, or, in other words, the combining, in the same web, of a pattern, or fancy figure, with the crossing colors which constitute the check. Mr. Cartwright made no reply to this observation, at the time; but some weeks after, on receiving a second visit from the same person, he had the pleasure of showing him a piece of muslin, of the description mentioned, beautifully executed by machinery. The man is said to have been so much astonished, that he roundly declared his conviction that some agency, more than human, must have been called in to assist on the occasion.

After this, Dr. Cartwright exercised his ingenuity in a variety of other contrivances; and introduced valuable improvements in the combing of wool by machinery, in rope-making, and in several other departments of agriculture and manufactures. For some of these inventions, he took out patents, and for others, premiums were be-

stowed upon him by the Society for the Encouragement of Arts, and the Board of Agriculture. Even the steam-engine engaged his attention; and an account of some improvements, which he proposed in its mechanism, may be found in Rees's Cyclopedia. Indeed, so long as forty years ago, while residing at Eltham in Lincolnshire, he used frequently to tell his son that, if he lived to be a man, he would see both ships and land-carriages impelled by steam. It is also certain, that, at that early period, he had constructed a model of a steam-engine, attached to a barge, which he explained, about the year 1793, in the presence of his family, to Robert Fulton, then a student of painting under his countryman West, and whose zeal and activity afterwards, as is well known, brought the project of steam-navigation to such perfection in the United States, whence it has extended all over the civilized world.* Even so late as the year 1822, Dr. Cartwright, notwithstanding his very advanced age, and although his attention was much occupied by other philosophical speculations, was actively engaged in endeavoring to contrive a plan of propelling land-carriages by steam.

His death, however, at Hastings, in October, 1823, prevented the completion of this, as well as of many other designs in the prosecution of which he had been employed. His enthusiasm for mechanical invention continued unabated to the last; and, indeed, his general energy, both of mind and body, was very little impaired, up to within a short period of his death. In a letter to his brother, Major Cartwright, dated 24th April, 1819, he says, "I this day entered into my 77th year, in as good health and spirits, thank God, as I have done on any one birthday, for the last half century. I am moving about my farm, from eight o'clock in the morning, till four in the afternoon, without suffering the least fatigue. I sent in my claim to the Board of Agriculture, for their premium

* [For a Life of Fulton, and a notice of his various labours in connexion with steam navigation, see Vol. I., of 'Lives of Eminent Individuals, celebrated in American History,' constituting Vol. IV., of 'THE SCHOOL LIBRARY.']

for a cure of the mildew on wheat, but have not yet heard that it was admitted. I don't know whether I ever mentioned to you a machine for dibbling or planting wheat, which I have brought to great perfection. I have also a very material improvement on the stocks, respecting ploughs and wheel-carriages; but of this I shall say nothing till I have brought it to the proof, which I hope to do very shortly; when you shall be immediately informed of the result, whether favorable or not." The following verses, also, which he sent to a friend, not long before his death, will show at once the undiminished ardor and activity of his mind, and the generous and philanthropic motives, by which his enthusiasm was sustained and directed :—

" Since even Newton owns that all he wrought
Was due to industry and patient thought,
What shall restrain the impulse which I feel
To forward, as I may, the public weal?
By his example fired, to break away,
In search of truth, through darkness into day?
He tried, on venturous wing, the loftiest flight,
An eagle soaring to the fount of light!
I cling to earth, to earthborn arts confined,
A worm of science of the humblest kind.
Our powers, though wide apart as earth and heaven,
For different purposes alike were given:
Though mine the arena of inglorious fame,
Where pride and folly would the strife disdain,
With mind unwearied still will I engage,
In spite of failing vigor and of age,
Nor quit the combat till I quit the stage;
Or, if in idleness my life shall close,
Let well-earned victory justify repose!"

The disposition of this excellent man, indeed, naturally carried him, throughout his life, to promote, by every means in his power, the benefit of his fellow creatures; and the following incident is perhaps worthy of being recorded, as illustrating how this tendency used to display itself in other parts of his conduct, as well as in his zeal for mechanical improvements. While he held the living of Goadly Maxwood, in Leicestershire, he applied himself so assiduously to the study of medicine, that he

acquired extensive knowledge and eminent skill in that science, and was in the habit of prescribing to his poorer parishioners, with great success.

Actuated by such feelings as those we have described, Dr. Cartwright was as free as any man who ever lived, from jealousy or illiberality towards other inventors. In fact, it may be safely asserted, that had he not carried his frankness and want of suspicion, as well as his indifference to pecuniary gains, beyond the limits of worldly prudence, his ingenious contrivances would in all probability have been productive of much greater benefit to himself than they ever actually were. So careless was he, in regard to retaining, in his own possession, the valuable ideas with which his mind was continually teeming, that he has been frequently known to have given the most important assistance, by his suggestions, to other persons, engaged like himself in mechanical pursuits, and afterwards to have forgotten the circumstance, as entirely as if it had never happened. Nay, so completely did what he was engaged about at the moment, occupy his mind, that he sometimes forgot his own inventions, and other productions, of an older date, even when his attention was particularly called to them. One day, one of his daughters having chanced to repeat in his presence some lines from a poem, entitled, the 'Prince of Peace,' which appeared in his volume already mentioned, he exclaimed, to her surprise and amusement, "Those are beautiful lines, child; where did you meet with them!" On another occasion, being shown the model of a machine, he examined it with great attention, and at last observed, that the inventor must have been a man of great ingenuity, and that he himself should feel very proud, if he had been the author of the contrivance; nor could he be immediately convinced, of what was proved to be the case, namely, that it was a machine of his own.

Dr. Cartwright was deprived of the pecuniary profits which he might reasonably have expected from his great invention of the power-loom, by various accidents, and especially by the burning of a manufactory, containing five hundred of his machines, almost immediately after it

was built. It may also be added, that after he had demonstrated the practicability of weaving by machinery, other inventors applied themselves to the devising of contrivances for that purpose, slightly different from his,—a comparatively easy task, even where the new invention was not merely a disguised infringement of his patent, while in those cases, in which it was in reality nothing more than such an infringement, it was yet so protected, that it could hardly be reached and put down as such. On these, and other accounts, and in no small degree owing to Dr. Cartwright's carelessness about his own interests, the power-loom only began, in point of fact, to be extensively introduced about the year 1801, the very year in which his patent expired. So generally, however, was it felt among those best entitled to express an opinion on the subject, that to him really belonged the merit of the invention, that in the year 1808, several merchants and manufacturers of Manchester and its neighborhood, to none of whom he was personally known, held a meeting, to consider the propriety of presenting, to the Lords of the Treasury, a memorial of his eminent services, and of the losses he had sustained through the piracies and other unfortunate circumstances to which we have alluded. In consequence of this, and other applications in his favor, the sum of ten thousand pounds was soon after granted to him by the British Parliament. This national recognition of his claims, may be taken as a sufficient answer to some attempts that have been occasionally made to rob him of the credit of having been the author of one of the most valuable presents ever made to the manufacturing industry of his country.

As a man of education and literary habits, the inventor of the power-loom, notwithstanding his deviation from his original track of thought and study, when he began to give his attention to mechanics, may yet be said to have come even to that new line of pursuit, with certain acquired advantages. He brought with him, at least, a mind awakened to some knowledge of its own powers, by the general cultivation it had received, and not undisciplined by its accustomed exercises, to habits of specula-

tion and inquiry. The individual we are next to mention, who also rose to eminence in what may be called a department of mechanics, was, in these respects, very differently circumstanced.

WILLIAM EDWARDS, the celebrated Welsh engineer, was born in 1719, in the parish of Eglwysilan, in Glamorganshire. He lost his father, who was a farmer, when he was only two years old; but his mother continued to hold the farm, and was in this manner enabled to bring up her family, consisting of two other sons and a daughter, besides William, who was the youngest. Her other sons, indeed, were soon old enough to take the chief part of her charge off her hands. William, in the mean time, was taught, as he grew up, to read and write Welsh; and this was all the education he seems to have received. When about the age of fifteen, he first began to employ himself in repairing the stone fences on the farm; and in this humble species of masonry, he soon acquired uncommon expertness. The excellent work he made, and the despatch with which he got through it, at last attracted the notice of the neighboring farmers; and they advised his brothers to keep him at this business, and to let him employ his skill, when wanted, on other farms as well as their own. After this, he was for some time constantly engaged; and he regularly added his earnings to the common stock of the family.

Hitherto, the only sort of building he had practised, or indeed had seen practised, was merely with stones, without mortar. But at length, it happened, that some masons came to the parish, to erect a shed for shoeing horses, near a smith's shop. By William, the operations of these architects were contemplated with the liveliest interest, and he used to stand by them, for hours, while they were at work, taking note of every movement they made. A circumstance, that at once struck him, was, that they used a different description of hammer from what he had been accustomed to employ; and, perceiving its superiority, he immediately got one of the same kind made for himself. With this, he found he could build his walls, both a great deal faster, and more neatly,

than he had been wont to do. But it was not long after he had, for the first time in his life, had an opportunity of seeing how houses were erected, that he undertook to build one, himself. It was a workshop for a neighbor; and he performed his task in such a manner, as obtained him great applause. Very soon after this, he was employed to erect a mill, by which he still further increased his reputation, as an able and ingenious workman. Mr. Malkin, to whose work on the Scenery, &c., of South Wales, we are indebted for these particulars of Edwards's early life, as well as for the materials of the sequel of our sketch, says, that it was while building this mill, that the self-taught architect became acquainted with the principle of the arch.

After this achievement, Edwards was accounted the best workman in that part of the country; and being highly esteemed for his integrity and fidelity to his engagements, as well as for his skill, he had as much employment in his line of a common builder, as he could undertake. In his twenty-seventh year, however, he was induced to engage in an enterprise of a more much difficult and important character, than any thing he had hitherto attempted.

Through his native parish, in which he still continued to reside, flowed the river, called the Taff, which, following a southward course, flows at last into the estuary of the Severn. It was proposed to throw a bridge over this river, at a particular spot in the parish of Eglwysilan, where it crossed the line of an intended road; but to this design, difficulties, of a somewhat formidable nature, presented themselves, owing both to the great breadth of the water, and the frequent swellings to which it was subject. Mountains, covered with wood, rose to a considerable height from both its banks; which first attracted and detained every approaching cloud, and then sent down its collected discharge in torrents into the river. Edwards, however, undertook the task of constructing the proposed bridge, though it was the first work of the kind in which he ever had engaged. Accordingly, in the year 1746, he set to work; and, in due time, completed a very light

and elegant bridge, of three arches, which, notwithstanding that it was the work of both an entirely self-taught and an equally untravelled artist, was acknowledged to be superior to any thing of the kind, in Wales.

So far, his success had been as perfect as could have been desired. But his undertaking was far from being yet finished. He had, both through himself and his friends, given security that the work should stand for seven years; and for the first two years and a half of this term, all went on well. There then occurred a flood of extraordinary magnitude; not only the torrents came down from the mountains in their accustomed channels, but they brought along with them trees of the largest size, which they had torn up by the roots; and these, detained, as they floated along, by the middle piers of the new bridge, formed a dam there, the waters accumulated behind which at length burst from their confinement, and swept away the whole structure.

This was no light misfortune, in every way, to poor Edwards; but he did not suffer himself to be disheartened by it, and immediately proceeded, as his contract bound him to do, to the erection of another bridge, in the room of the one that had been destroyed. He now determined, however, to adopt a very magnificent idea—to span the whole width of the river, namely, by a single arch of the unexampled magnitude of one hundred and forty feet from pier to pier. He finished the erection of this stupendous arch, in 1751, and had only to add the parapets, when he was doomed once more to behold his bridge sink into the water over which he had raised it, the extraordinary weight of the masonry having forced up the keystone, and, of course, at once deprived the arch of what sustained its equipoise.

Heavy as was this second disappointment, to the hopes of the young architect, it did not shake his courage, any more than the former had done. The reconstruction of his bridge, for the third time, was immediately begun with unabated spirit and confidence. Still determined to adhere to his last plan of a single arch, he had now thought of an ingenious contrivance for diminishing the enormous

weight which had formerly forced the keystone out of its place. In each of the large masses of masonry, called the haunches of the bridge, being the parts immediately above the two extremities of the arch, he opened three cylindrical holes, which not only relieved the central part of the structure from all over-pressure, but greatly improved its general appearance in point of lightness and elegance. The bridge, with this improvement, was finished in 1755, having occupied the architect about nine years, in all; and it has stood ever since.

This bridge over the Taff—commonly called the *New Bridge*, and, by the Welsh, *Pont y Pridd*, was, at the time of its erection, the largest stone arch, known to exist in the world. Before its erection, the Rialto, at Venice, the span of which was only ninety-eight feet, was entitled, as Mr. Malkin remarks, to this distinction among bridges; unless, indeed, we are to include the famous aqueduct bridge, at Alcantara, near Lisbon, consisting in all of thirty-five arches, the eighth of which is rather more than a hundred and eight feet in width, and two hundred and twenty-seven in height. The bridge at Alcantara was finished in 1732.

Since the erection of the bridge over the Taff, several other stone arches of extraordinary dimensions have been built, both in England and in France,—such, for instance, as the five composing the splendid Pont de Neuilly, over the Seine, near Paris, the span of each of which is a hundred and twenty-eight feet; the central arch of the bridge over the same river, at Mantes, which is of the same dimensions; the Island Bridge, as it is called, over the Liffey, near Dublin, which is a single arch of a hundred and six feet in width; the bridge over the Tees, at Winston, in Yorkshire, which is also a single arch of a hundred and eight feet nine inches wide, and which was built in 1762, by John Johnson, a common mason, at a cost of only five hundred pounds; and the nine elliptical arches, each of a hundred and twenty feet span, forming the magnificent Waterloo Bridge, over the Thames at London. But no one of these great works, rivals in respect of dimensions, the arch constructed by Ed-

wards.* The bridge over the Taff, we may add, rises to the height of thirty-five feet above the water, and is the segment of a circle of a hundred and seventy feet in diameter. Buttressed as it is at each extremity by lofty mountains, while the water flows in full tide beneath it, its aspect, as it is seen rising into the air, may well be conceived to be particularly striking and grand.

This bridge, which is looked upon as a wonder to this day, spread the fame of Edwards over all the country. He afterwards built many other bridges in South Wales, several of which, consisted also of single arches, of considerable width, although in no case approaching to that of the arch over the Taff. One, which he erected over the Tawy, near Swansea, had a span of eighty feet; another at Llandovery, in Carmarthenshire, was eighty-four feet wide; and a third, Wychbree Bridge, over the Tawy, was of the width of ninety-five feet. All the bridges, which Edwards built, after his first attempt, have their arches formed of segments of much larger circles than he ventured to try in that case; and the roads over them are consequently much flatter, a convenience which amply compensates for their inferiority in point of imposing appearance. He found his way to this improvement, entirely by his own experience and sagacity; as indeed he may be said to have done to all the knowledge he possessed in his art. Even his principles of common masonry, he used himself to declare, he had learned chiefly from his studies among the ruins of an old Gothic castle, in his native parish. In bridge building, the three objects which he always strove to attain, in the highest possible degree, were, first, durability; secondly, freedom for the passage of the water under the bridge; and lastly, ease of traffic over it.

In commencing architect, Edwards did not abandon the business of his forefathers. He was likewise a far-

* A bridge has, however, since been built at Chester, England, which is the largest single arch in the world, being two hundred feet span. A bridge over the Severn, at Gloucester, England, is one hundred and fifty feet span; and the arches of the New London Bridge, are larger than that of Pont y Pridd.

mer, to the end of his life. Nay, such was his unwearied activity, that, not satisfied with his week-day labors, in these two capacities, he also officiated on Sundays, as pastor to an Independent congregation, having been regularly ordained to that office, when he was about thirty years of age, and holding it till his death. He accepted the usual salary from his congregation, considering it right that they should support their minister; but instead of putting the money into his own pocket, he returned it all, and often much more, in charity to the poor. He always preached in Welsh, although early in life he had also made himself acquainted with the English language, having embraced the opportunity of acquiring it under the tuition of a blind old schoolmaster, in whose house he once lodged, for a short time, while doing some work at the county town of Cardiff. He is said to have shown all his characteristic assiduity of application, in this effort, and to have made a correspondingly rapid progress.

This ingenious and worthy man died in 1789, in the seventieth year of his age, leaving a family of six children, of whom his eldest son, David, became also an eminent architect and bridge-builder, although he had had no other instruction in his profession, than what his father had given him. David's eldest son, is also said to have inherited the genius of his father and his grandfather.

The mention of Edwards's clerical occupation, leads us to conclude our chapter, by a few words respecting the *Wonderful* Robert Walker, as he is still called in the district of the country, where he resided, who was curate of Seathwaite, in Cumberland, during the greater part of last century. The fullest account that has appeared of Mr. Walker, is that given in the notes to his series of sonnets, entitled, 'The River Duddon,' by Mr. Wordsworth, in whose poem of the Excursion, the worthy clergyman is also noticed with the commendations due to his singular virtues. From this memoir, it appears that Walker was born in the parish of Seathwaite, in 1709; that, being of delicate constitution, it was determined by his parents, whose youngest child he was, to breed him a scholar; and that, accordingly, he

was taught the elements of reading, writing, and arithmetic, by the clergyman of the parish, who also officiated as schoolmaster. He afterwards contrived to acquire a knowledge of the classics; and, becoming in this manner qualified for taking holy orders, was ordained, and appointed to the curacy of his native parish, which was at this time, (about the year 1735,) of the value of five pounds per annum. On obtaining possession of this living, Walker married, his wife bringing him what he calls himself, in one of his letters, a "fortune" of forty pounds.

We must refer to Mr. Wordsworth's pages, and the documents which will be found printed there, for a detail of all that the industry and economy of the curate and his wife contrived to accomplish, upon these scanty resources. Suffice it to say, that about twenty years after Walker's entrance upon his living, we find its value, according to his own statement, increased only to the amount in all of seventeen pounds ten shillings. At a subsequent period, it received a further augmentation, to what amount, is not stated; but it was not considerable. Before this, Mr. Walker had declined to accept the adjoining curacy of Ulpha, to be held, as proposed by the bishop, in conjunction with that of Seathwaite, considering, as he says himself, that the annexation "would be apt to cause a general discontent among the inhabitants of both places, by either thinking themselves slighted, being only served alternately, or neglected in the duty, or attributing it to covetousness in me; all which occasions of murmuring I would willingly avoid." Yet at this time, he had a family of eight or nine children. One of his sons, he afterwards maintained at the college of Dublin, till he was ready for taking holy orders.

He was, like his predecessors in the same cure, schoolmaster as well as clergyman of his parish; but "he made no charge," says his biographer, "for teaching school; such as could afford to pay, gave him what they pleased." His hospitality to his parishioners every Sunday was literally without limitation; he kept a plentiful table, for all who chose to come. Economical as he was, no act of

his life was chargeable with any thing in the least degree savoring of avarice; on the contrary, many parts of his conduct displayed, what in any station would have been deemed extraordinary disinterestedness and generosity. Finally, at his death, in 1802, he actually left behind him no less a sum, than two thousand pounds.

There is, in all this, as Mr. Wordsworth remarks, something so extraordinary, as to make some explanatory details necessary. These we shall give in his own words. "And to begin," says he, "with his industry; eight hours, in each day, during five days in the week, and half of Saturday, except when the labors of husbandry were urgent, he was occupied in teaching. His seat was within the rails of the altar; the communion table was his desk; and, like Shenstone's schoolmistress, the master employed himself at the spinning-wheel, while the children were repeating their lessons by his side. Every evening, after school hours, if not more profitably engaged, he continued the same kind of labor, exchanging, for the benefit of exercise, the small wheel, at which he had sat, for the large one on which wool is spun, the spinner stepping to and fro. Thus was the wheel constantly in readiness, to prevent the waste of a moment's time.

"Nor was his industry with the pen, when occasion called for it, less eager. Intrusted with extensive management of public and private affairs, he acted in his rustic neighborhood, as scrivener, writing out petitions, deeds of conveyance, wills, covenants, &c., with pecuniary gain to himself, and to the great benefit of his employers. These labors, at all times considerable, at one period of the year, viz., between Christmas and Candlemas, when money transactions are settled in that part of the country, were often so intense, that he passed great part of the night, and sometimes whole nights, at his desk. His garden, also, was tilled by his own hand; he had a right of pasturage upon the mountains for a few sheep and a couple of cows, which required his attendance; with this pastoral occupation, he joined the labors of husbandry upon a small scale, renting two or three acres, in addi-

tion to his own, less than one acre of glebe; and the humblest drudgery, which the cultivation of these fields required, was performed by himself. He also assisted his neighbors in haymaking and shearing their flocks, and in the performance of this latter service, he was eminently dexterous. They, in their turn, complimented him with the present of a haycock, or a fleece; less as a recompense for this particular service than as a general acknowledgement.

"The sabbath was in a strict sense kept holy; the Sunday evenings being devoted to reading the scripture and family prayer. The principal festivals appointed by the Church, were also duly observed; but through every other day in the week, through every week in the year, he was incessantly occupied in works of hand or mind; not allowing a moment for recreation, except upon a Saturday afternoon, when he indulged himself with a newspaper, or sometimes with a magazine. The frugality and temperance established in his house, were as admirable as the industry. Nothing to which the name of luxury could be given, was there known; in the latter part of his life, indeed, when tea had been brought into almost general use, it was provided for visiters, and for such of his own family as returned occasionally to his roof, and had been accustomed to this refreshment elsewhere; but neither he nor his wife ever partook of it.

"The raiment worn by his family, was comely and decent, but as simple as their diet; the homespun materials were made up into apparel, by their own hands. At the time of the decease of this thrifty pair, their cottage contained a large store of webs of woollen and linen cloth, woven from thread of their own spinning. And it is remarkable that the pew in the chapel in which the family used to sit, remained, a few years ago, neatly lined with woollen cloth, spun by the pastor's own hands. It is the only pew in the chapel, so distinguished; and I know of no other instance of his conformity to the delicate accommodations of modern times.

"The fuel of the house, like that of their neighbors, consisted of peat, procured from the mosses by their own

labor. The lights by which, in the winter evenings, their work was performed, were of their own manufacture, such as still continue to be used in these cottages; they are made of the pith of rushes dipped in fat. *White* candles, as tallow candles are here called, were reserved to honor the Christmas festivals, and were, perhaps, produced upon no other occasions. Once a month, during the proper season, a sheep was drawn from their small mountain flock, and killed for the use of the family; and a cow, towards the close of the year, was salted and dried, for winter provision; the hide was tanned to furnish them with shoes. By these various resources, this venerable clergyman reared a numerous family; not only preserving them, as he affectingly says, 'from wanting the necessaries of life,' but affording them an unstinted education, and the means of raising themselves in society."

All this, if not a lesson in the pursuit of knowledge, is at least a striking example of what assiduity and perseverance will do, in any pursuit, as well as highly instructive with regard to one of the most important subjects that can engage the attention of literary or scientific students, the art, namely, of husbanding time, and employing it to the best advantage. But with all his industry of another description, Mr. Walker did not find it impossible to nourish and exercise also his mental powers. "It might have been concluded," his biographer proceeds, "that no one could thus, as it were, have converted his body into a machine of industry, for the humblest uses, and kept his thoughts so frequently bent upon secular concerns, without grievous injury to the more precious parts of his nature. How could the powers of intellect thrive, or its graces be displayed, in the midst of circumstances apparently so unfavorable, and when, to the direct cultivation of the mind, so small a portion of time was allotted? But, in this extraordinary man, things in their nature adverse were reconciled; his conversation was remarkable, not only for being chaste and pure, but for the degree in which it was fervent and eloquent; his written style was correct, simple, and animated.

"Nor did his *affections* suffer more than his intellect; he was tenderly alive to all the duties of his pastoral office; the poor and needy 'he never sent empty away;' the stranger was fed and refreshed in passing that unfrequented vale; the sick were visited; and the feelings of humanity found further exercise among the distresses and embarrassments in the worldly estate of his neighbors, with which his talents for business made him acquainted; and the disinterestedness, impartiality, and uprightness, which he maintained, in the management of all affairs confided to him, were virtues seldom separated, in his own conscience, from religious obligations.

"Nor could such conduct fail to remind those who witnessed it, of a spirit nobler than law or custom; they felt convictions, which, but for such intercourse, could not have been afforded, that, as in the practice of their pastor, there was no guile, so in his faith there was nothing hollow; and we are warranted in believing that, upon these occasions, selfishness, obstinacy, and discord would often give way before the breathings of his good will and saintly integrity. It may be presumed, also, while his humble congregation were listening to the moral precepts which he delivered from the pulpit, and to the Christian exhortations, that they should love their neighbor as themselves, and do as they would be done unto, that peculiar efficacy was given to the preacher's labors, by recollections in the minds of his congregation, that they were called upon to do no more than his own actions were daily setting before their eyes."

What may be deemed out of character, we may merely add, in some of the occupations, in which this excellent clergyman was wont to employ himself, ought to be judged of with a reference both to the times in which he was born and grew up, and to the simple and sequestered population among whom it was his lot to pass his life. "Had he lived," says Mr. Wordsworth, justly, "at a later period, the principle of duty would have produced application as unremitting; the same energy of character would have been displayed, though in many instances with widely different effects."

CHAPTER XV.

Pursuit of Knowledge by Travellers:—Lithgow; Walking Stewart; Athenian Stuart; Niebuhr.

Books, immense as their value really is, are overrated, when it is supposed that they may be made to teach us every thing. Many of the items, which constitute the mass of human knowledge, have not yet found their way into books, but remain still loose and ungathered, among the habits and daily transactions of society, or of some particular portion of it, from intercourse with which, they are much more easily and perfectly learned, than they could be from books, were they actually to be there recorded. But much of what meets us in our direct intercourse with the world, and supplies us with the richest sources of reflection and speculation, does not admit of being transferred to books at all. Indeed, what should any one of us know of that country, or portion of society, with which we happen to be most familiar, if all our knowledge of it, consisted, merely, either of what has been, or of what could be, set down about it in books? What mere description, even the most minute and faithful, ever placed before any man an exact representation, even of a scene in the world of inanimate nature? The copy, it is true, simply by virtue of its being a copy, may have charms which the reality wants; but that is not the question. The one is something entirely *different* from the other, and produces a different impression upon the mind. Much more must this be the case, when the subject of the description is something, that, from the more various, complicated, and shifting nature of its relations and lineaments, and from much of its character not showing itself to the eye at all, still less admits of being

thrown into the shape of a picture. The moral condition, indeed, of a country and its inhabitants, is constituted by so multifarious a concourse of circumstances, that their number and diversity alone would preclude them from being adequately represented, in their working and effect, by any description. To be felt and understood, in their real power and combined agency, they must be seen and experienced. A general judgement with regard to the matter, may undoubtedly be formed from the reports of others; and from such reports, also, filled up and colored by the mind of the reader or hearer, a sufficiently vivid picture of something, having a certain resemblance to the original, may be drawn; but the real features of that original, are nevertheless sure to be in a thousand respects misconceived. Hence, with regard to certain subjects, and these neither the least interesting, nor the least important to be known, travelling becomes a means of acquiring knowledge, for which, in fact, there is no substitute. Crowded, too, as is this path of enterprise, with so many, both of the hazards and the opportunities, most alluring to a warm imagination, it is not to be wondered at, that it should always have had a peculiar charm for active and adventurous spirits, and that, in no other pursuit whatever, should greater toils, privations, and dangers, have been encountered and overcome.

In the small space that now remains to us, we cannot attempt to enumerate many names from the long catalogue of celebrated travellers; but our work would be very incomplete, without a reference to a few of the most distinguished of those examples, which recent times have afforded, of this species of devotion in the pursuit of knowledge. There is no other, as we have just remarked, which has sustained men in the endurance of more severe and prolonged sufferings, or more frequently tempted them to peril every thing, even life itself, in the effort to attain their object.

Some have performed journeys of wonderful extent and difficulty, on foot. Of this class, is WILLIAM LITHGOW, who was born in Scotland, about the end of the

sixteenth century. This person, in a history of his adventures, which he published in 1614, and which has been more than once reprinted, computes the extent of his pedestrian wanderings, over various countries in Europe, Asia, and Africa, at no less than thirty-six thousand miles. He underwent many hardships, in the course of his peregrinations; but the worst misfortune which befell him, was what he suffered on his return home, when he was seized at Malaga, in Spain, by the Inquisition, and subjected both to the ordinary and the extraordinary torture. So dreadfully was he disabled by the injuries he received on this occasion, that after he reached England and it was proposed that he should make his appearance at Court to present his book to James I., he had to be carried thither on a litter, his worn and emaciated form exciting the astonishment of all who looked on it. Lithgow, who afterwards recovered his health, died in 1640.

The late Mr. JOHN STEWART, commonly called Walking Stewart, affords us another instance, which deserves to be commemorated, under this head. Mr. Stewart had only recently gone out to Madras, as a writer in the service of the East India Company, when, in the year 1765, he formed the extraordinary resolution of leaving the Presidency, and setting out to travel on foot over the world. The first thing which he did, in pursuance of this determination, was to write a letter to the Directors, in which he told them, that he "was born for higher pursuits, than to be a copier of invoices and bills of lading to a company of grocers, haberdashers, and cheesemongers." This heroic epistle, which doubtless not a little amused the persons to whom it was addressed, is said to be still preserved among the records of the Company. Its spirited author lost very little time, after despatching it, in proceeding to execute his project. He first directed his course to Delhi; and he subsequently visited, in the same manner, almost every other part of the Indian peninsula, and even extended his excursions to Persia, and, crossing the Red Sea, traversed a considerable portion of the opposite continent of Africa. Finally, he determined to make out the journey to Eu-

rope on foot, which he actually accomplished, arriving at length, in safety, at Marseilles, after surmounting a long succession of difficulties by the most unconquerable perseverance. He then made a tour through Spain, walked across France, and afterwards returned to his native country. But he had not come home, even after all this exertion, to repose from his toils. He soon after set out on a pedestrian perambulation, over England, Scotland, and Ireland; and that finished, he proceeded to the New World, and walked over the greater part of the United States. Such performances, will be acknowledged to have amply earned for their author the epithet by which he was distinguished.

Walking Stewart must not be confounded with Mr. James Stuart, commonly called Athenian Stuart, from his splendid work, entitled, 'The Antiquities of Athens,' who, it so happens, is also famous for his travels, a considerable part of which, was performed on foot. Indeed, Stuart's life is altogether a fine instance of devotion to the pursuit of knowledge. He was born in London, in 1713, and by the early death of his father, was left, while yet a boy, to support his mother and her three younger children, by the exercise of his almost uninstructed talents, in the humble occupation of painting fans. While sustaining this heavy charge, he found time to study, almost without assistance, not only the higher departments of the art of drawing, but anatomy, geometry, and other branches of science, the knowledge of which, he deemed essential to his professional progress, as a draughtsman and painter. He even taught himself Latin, excited by a desire to understand the inscriptions in that language which he used to see under engravings; and he afterwards proceeded to the study of Greek. But the knowledge he found in books, was insufficient to satisfy him; he could take no rest, until he had seen, with his own eyes, those lands of Italy and Greece, of which he had read so much. He therefore made preparations for travel; and let it be recorded to his honor, that the first thing he did was to exert himself to obtain situations for his sister and his two younger brothers, which, although

humble, might enable them to support themselves and their mother during his absence. An anecdote is also told of him, which places in a striking point of view, the resolute enthusiasm with which he set out on his enterprise.

He had a dangerous wen on his face, which a surgeon whom he consulted, advised him to endeavor to get removed, before commencing his travels. As the least hazardous mode of treatment, it was, at the same time, proposed to submit it to a course of medical applications, which would occupy a considerable time. Stuart, himself, however, immediately asked if an operation could not be attempted. On being informed, in reply, that it certainly might, but that it would be attended with some danger, he reflected a moment, and then placing himself on a chair, requested the surgeon to proceed immediately to apply the knife; "I," said he, "shall not stir." The operation, fortunately, was performed with perfect success. Stuart then set out, on foot, and in this manner accomplished the journey to Rome. He had little or no money in his pocket; but he supported himself on his way by the paintings which he executed and sold. While at Rome, he became acquainted with Mr. Revett, the architect, with whom he afterwards proceeded to Greece. It was during a residence of some years in that country, that he collected the materials for his great work, already mentioned, which was published in 1762, and immediately introduced its author both to fame and to abundant and lucrative employment in the new profession of an architect, which he had resolved to embrace. He was afterwards appointed surveyor of Greenwich Hospital, and became a Fellow of the Royal and of the Antiquarian Societies. Mr. Stuart died in 1788.

One of the greatest travellers, of whom modern times have had to boast, is the celebrated CARSTEN NIEBUHR; and his early history is also interesting, as exhibiting a persevering pursuit of knowledge in the face of considerable difficulties, and with nothing to urge him forward except his own desire of intellectual improvement.

He sprung from the ranks of the people, and retained through life his sympathies with them. At the highest point

of elevation to which he attained, favored by his prince, respected and admired by the learned and eminent of all countries, it was his pride that he was born a peasant of Free Friesland. His manners never lost the simplicity, nor his morals the purity of that singular and estimable class of men. If ever there lived a man, who might safely and reasonably be held up to the people as an object of imitation, it was Carsten Niebuhr. Not only was he a poor man,—an orphan,—born in a remote part of a remote province, far from all those facilities for acquiring knowledge, which in this age and country are poured out before the feet of the people; he was not even gifted in any extraordinary way by Nature. He was in no sense of the word, a *genius*. He had, as his eminent son and biographer remarks, no imagination; his power of acquiring does not seem to have been extraordinarily rapid, nor his memory singularly retentive. In all cases where the force of that will, at once steady and ardent, which enabled him to master his favorite studies, was not brought to bear, his progress was slow and inconsiderable. It is not, therefore, in any supposed intellectual advantages, that we must look for the causes of his rise to eminence. They are to be found, rather in the moral qualities, which distinguished him, qualities attainable in a greater or less degree, by men of the humblest rank, of the most homely intellect, the least favored by situation or connexion. It will well repay us, to look a little more nearly into these qualities; they are the bases of every thing which a man of unperverted judgement and taste, would respect in others, or desire in himself.

He possessed, in an eminent degree, the distinguishing virtues of his country,—sincerity, unadulterated and faithful love of truth, and honesty. The zeal with which he gave himself to a pursuit which might enable him to be useful to his native district;—the total absence of vanity and of all interested motives which characterized the whole course of his studies and of his journeyings;—the simplicity of his narrative, in which no more of himself and his individual feelings appears, than is just necessary to keep up the thread of the story;—the rigorous accu-

racy and anxiety after the truth, for which his travels have ever been, and still remain, preeminently distinguished, among all who preceded, and all who have followed, him, on the same ground, afford ample evidence of the singleness and the steadiness of the motives which actuated him. The punctilious honor which distinguished his disbursement of the funds intrusted to his care by the Danish government; the exactness with which he abstained from applying a farthing of this money to any object which could be considered by others or which his own more fastidious delicacy could regard, as a personal gratification, (though connected, as all his pleasures were, with the interests of science and the scope of his mission,) prove that honor is confined to no class, but that its highest refinements are within the reach of the humblest.

His self-command was perfect. He could abstain from what was agreeable, and do what was disagreeable to him. He was, of course, sober, temperate even to abstemiousness, laborious, and persevering; neither discouraged nor elated by the incidents, which, he must have known, were inseparable from the career he had chosen.

The more tranquil and uniform course of life which he led, from the time of his marriage till his death; his conduct, as a father of a family and a citizen, are marked by the same integrity, active usefulness, and simplicity. It was not one of the smallest benefits he conferred upon his country and society, that he imbued his illustrious son with the same fervent and steady zeal for truth and freedom, the same devotion to science, the same respect for all that is beneficent and honorable, which animated his own blameless and useful life. Happy the country which can draw such men as Niebuhr from the ranks of her peasantry to the highest walks of science, and the most important posts in her service!

Hadeln, as we are informed by the historical notice at the end of the ancient Frisian laws, printed at Wittewierum, was a province of Friesland, and formerly, under the name of Hadelre, belonged to the seventh *Seeland*,*

* Friesland, divided into seven Seelanden, or provinces, was exposed to frequent landings of the Normans on their coast, and on the landside

or maritime district. At the dissolution of the great Frisian federation, it lost its republican freedom, and after experiencing various fortunes, fell into the hands of the Dukes of Saxelauenburg, and, together with that duchy, devolved to Hanover.

The country consists of marsh, with the exception of three parishes of moorland: the peasantry are, as usual in Friesland, universally free proprietors, every one of whom possesses, inhabits, and cultivates his farm, with the fullest and most perfect enjoyment of the rights of property. Down to the time of the French conquest, the local administration was free, in the hands of magistrates chosen by the peasantry;—the taxes were extremely light, and the prosperity and comfort of the peasantry very great.*

In this country,—among these free men,—himself a free peasant, or yeoman,—was Carsten Niebuhr born, on the 17th of March, 1733, in his father's farm-house, in West Lüdingworth. His father and his ancestors, from his great-great-grandfather, downwards, (higher than whom our accounts do not reach,) lived as yeomen on their own marsh farm; in competence, though not in affluence.

It is a remarkable fact, that certain epochs produce men distinguished in the same art, or science, or talent,

to attacks from the neighboring Bishops and Counts. To secure themselves from external assult and from internal disquiet, the seven Seelanden formed themselves into a closely united body. This union was ratified at Upstalsboom in the middle of the 11th century, at a general assembly of the people.—*Wiarda.*

* The peasantry of Friesland enjoy many remarkable rights and liberties rarely to be found in other countries. At one time, the *Landstandschaft*, or right and dignity of legislative landed proprietors, was claimed by the freeholders, or hereditary owners of small portions of land. These freeholders are chiefly to be found in the marshes, and the marshmen are principally distinguished from the moorlanders from the rareness of allodial tenures, [or freehold estates,] among them. The freeholders possess the entire property of their land, and are subject to no one but the government, to which alone they pay taxes and render the service attached to the land. Those freemen who possess not considerable farms, but a few acres, are called Cotters, (Köther,) and generally carry on some other accessary or subordinate business.—*Ib.*

whilst other epochs are utterly barren of them. This was the case, in the north of Germany, with the contemporaries of Carsten Niebuhr. In or about the same year, occurred the births of Count Andrew Peter Bernstorf, of Reimarus, Hensler, the father, Behrens, and, at remoter distances of time and place, of many other celebrated men. The men of this time, were distinguished for a remarkable activity, a singular earnestness and zeal, and a robust health of body and of mind; they have left behind them the most durable monuments, in their works and in their actions. They came after Winkelmann, Kant, and Klopstock, by just such an interval, as to be rising up to maturity when the latter had reached it.

Carsten Niebuhr lost his mother, before he was six weeks old. He grew up under the care of a stepmother, in his father's house, where his way of life and his employments, as well as his education, were those common to the peasant boys of his country. It was, probably, owing to his own eager desire for knowledge, that his father was induced, only with a view to his being somewhat better instructed than a common peasant, to send him to the grammar school in Otterndorf, whence he afterwards went to that at Altenbruch. But the removal of the schoolmaster of that place, and the prejudices of his guardians, (for his father had died in the interval,) put an end to his school studies, before he had gone far enough, even to have them sufficiently impressed on his memory, to be of any service to him, when he afterwards resumed them.

The division of his father's property between the surviving children, had left him, instead of the farm which had been so long the hereditary possession of the family, only a very small capital, quite inadequate to the purchase of any land for himself; and necessity would have led him to acquire knowledge, as a means of subsistence, even if he had been of a character to endure to live, without education, and without employment. He was obliged, however, to content himself with such accomplishments, as were attainable without school learning; he, therefore, for a year, pursued music with great zeal,

and learned to play on several instruments, with a view to earn his living as an organist. As this employment, likewise, did not meet the approbation of his guardians, his maternal uncle took him home to his own house, where he passed about four years, during which his life was once more completely that of a peasant. The older he grew, however, the less could he endure the void and dulness of this way of life, which can only be relieved, either, as in old times, by a share in the general deliberations on the affairs of the community, and by cheerfulness and merriment, or, as is the case in the present day, by a participation in the advantages of education, and literary amusement. He felt an irresistible impulse to learn, to employ himself, and to render himself generally useful.

The purely accidental circumstances, which determine the course of life of distinguished men, deserve to be remembered. In the highest degree accidental, was that which gave to Niebuhr the direction which he thenceforward followed, until it led him to become the most eminent traveller of modern times. A lawsuit had arisen concerning the superficial contents of a farm, which could only be decided by measurement; and as there was no land-surveyor in Hadeln, the parties were obliged to send for one to another place. Niebuhr felt for the honor of his native district, with all the warmth of old times, and this occurrence appeared to him disgraceful to it: he could now fulfil a duty towards his country by learning the neglected art, which, at the same time, furnished him with an occupation, and an object, such as he desired. He was, in the mean time, come of age, and, as he learnt that instruction in practical geometry was to be had in Bremen, he immediately repaired thither. This plan was frustrated; the teacher, upon whom he reckoned, was dead; but he did not disdain the instructions of a humble practitioner of the art. He, however, would have been obliged to lodge and board in his house, and here the bashful, strictly decorous, and self-distrusting young peasant, found two town-bred young ladies, sisters of his intended teacher, whose attentions appeared to him so sin-

gular, that he quickly took his departure. He now turned his eyes toward Hamburgh, but there he was destined again to experience disappointment, and to have his perseverance put to the test.

He had passed his two-and-twentieth year, when he went to Hamburgh, to avail himself of Succow's instructions in mathematics, and, without any false shame on account of his age, to begin his school studies anew. His income was not sufficient to maintain him, even with that rigid frugality which was natural to him. He determined, however, to spend just so much of his small capital, as would enable him to accomplish his end. He arrived at Hamburgh, in the summer of the year 1755, as we find from his letters to President Beymgraben, the only friend of riper age and judgement he then possessed, by whose family they are reverentially preserved.

But just at this time, Succow was called to Jena: the mathematical chair was empty, and was not filled, until Büsch was appointed to it. The severest application to private instruction, was, therefore, necessary to make the lessons at the gymnasium (or public school) intelligible or profitable to him. A countryman of his, named Witke, who, at that time, lived in Hamburgh, as candidate for holy orders, and who afterwards died at Otterndorf, where he was pastor, gave him this private instruction, with true cordiality and friendship. Niebuhr always spoke of him as the person who laid the foundation of his education, and, as such, honored and loved him with grateful piety. Notwithstanding his uncommon exertions, and the strength both of his body and mind, twenty months, eight of which passed in merely preparatory studies, (for the Latin tongue was almost entirely unknown to him,) were quite insufficient for one who began to learn so late in life, to acquire that quantity of learning, which more fortunate youths bring with them to the university. Among other things, thus unavoidably neglected, was Greek, which he always greatly lamented the want of.

Under Büsch, he had begun to learn mathematics; he was the earliest and the most distinguished of all his pupils, and in afterlife became his most intimate friend.

To stop half-way in any undertaking, was thoroughly repugnant to his whole character. He had gone to Hamburgh, solely with a view to acquire a knowledge of geometry, and of some things commonly taught in schools; but as soon as he had become acquainted with the sciences, he could not rest, until he was able to embrace them in all their extent and depth, and in the Easter of 1757, he repaired to Göttingen. His pursuit continued to be mathematics; he was more than ever compelled, by the diminution of his little substance, to aim at some employment, by which he could maintain himself, and to which his studies would lead. This he now looked to, in the Hanoverian engineer corps, in which, (as was the case in almost all the military services of Germany,) men of efficient mathematical attainments were extremely rare, and might hope to become the makers of their fortunes, by merit.

He studied with the steadiness which a fixed, simple, and prudent plan of life insures, from the Easter of 1757, (when he came to the university,) for more than a year, undisturbed by the war which frequently raged around Göttingen.

At this time, he recollected that an endowment, or fund for exhibitions, existed at this university, and begged his friend to ascertain whether it was only for poor students, in the strict sense of the word; or whether it was endowed without that limitation, "as a means of persevering in the study of something useful and important. In this case, alone, could he allow himself to apply for it." He received it, and reserved it entirely for the purchase of instruments.

At this period, Frederic V. reigned in Denmark, in enviable tranquillity. Louis XIV.'s memory still shone throughout Europe, with all that false glitter which had hung around his name during his life, and he was well known to be the model, after which the ministers of the Danish monarch endeavored, as far as it was compatible with the character of a peaceful king, to form their sovereign. Seldom, however, have the aims of a minister been less liable to reproach, than those of the then Baron

J. H. E. Bernstorf; and, among all the statesmen of the continent, there was not, perhaps, one of his time so well informed, so intelligent, and so noble minded. Posterity will perhaps mention, as among his noblest actions, the emancipation of his serfs, or slaves of the soil; the leisure which he insured to Klopstock, and the scientific expedition he sent into Arabia. This enterprise was originally owing to Michaelis, who had represented to the minister of state, that many elucidations of the Old Testament might be obtained, by personal observation and inquiry in Arabia, which might be regarded as hitherto untrodden by European feet. The original idea, in the mind of its author, extended no further than this; that a single traveller—an Oriental scholar out of his own school—should be sent, by way of India, to Yemen; a plan which would then have caused the undertaking to end in nothing, even supposing the traveller ever to have found his way back. Fortunately, the minister immediately perceived the defectiveness of the scheme, and replied to it, by a proposal to render the mission far more extensive in its objects and outfit. Thus it happened, that the original and peculiar aim, at least in so far as concerned the questions which the originator of the plan suggested, dwindled into an infinitely subordinate object; whilst what was accomplished by those two men, to whom jointly, and to whom, alone, the fame of the expedition is due, grew into an importance, which had been neither foreseen nor aimed at by Michaelis.

The first project, was submitted to Baron von Bernstorf, as early as the year 1756. As he took it up with all the vivacity and liberality for which he was so remarkable, and fully empowered Michaelis to propose an Oriental scholar to him, it might have been expected that Michaelis would have proposed the man, who, among all his contemporaries, was unrivalled for his knowledge of the Arabic language, and, as all Germany knew, was fighting, inch by inch, with starvation,—Reiske,—whom, moreover, Michaelis had known from the time he was at school. Instead of him, he recommended a pupil of his own, named Von Haven, whose acquirements must, at

that time, have been those of a mere school-boy, since a two years' residence at Rome, (whither he went to prepare himself under the Maronites,) and even the journey itself, never raised them above the meanest mediocrity.

Michaelis was also commissioned by Baron von Bernstorf to propose the mathematicians and natural historians, by the fortunate association of whom with the mission, that minister gave it value and importance. For the choice of these men he applied to Kästner, a member of the Göttingen Society of Sciences, of which he was then director. One day in the summer of 1758, on K.'s way from a meeting of the society, to which he had just proposed Niebuhr, he walked into his room. "Have you a mind to go to Arabia?" said he. "Why not? if any body will pay my expenses," answered Niebuhr, whom nothing bound to home, and whom an unbounded eagerness after knowledge urged abroad. "The King of Denmark," replied Kästner, "will pay your expenses." He then explained the project and its origin. Niebuhr's resolution was taken in a moment, so far as his own inclination was concerned. But, as he thought very humbly of himself, and most reverentially of science and of the truly instructed, he despaired of his own ability and power of being useful. On this head, however, Kästner set him at ease, by the promise of a long term for preparation, which he might employ chiefly under Mayer in astronomy, and by the assurance, that, with his determined perseverance and industry, the allotted time would be fully sufficient. The same evening, Niebuhr, who wanted nothing to fix his resolution, but Mayer's promise to instruct him in astronomy, went to him. Mayer, who was not so sanguine a man as Kästner, cautioned him against a determination which, with his character, would be irrevocable; while he knew not the dangers and fatigues he was about to brave: he, however, promised the desired instruction.

Michaelis, whom he visited the following day, probably saw levity and precipitation in so prompt a resolution, and pressed upon him a delay of a week to reconsider the

matter. It passed, but Niebuhr did not trouble himself with any further deliberation on a subject upon which his mind was already thoroughly resolved, and Michaelis now regarded the engagement as definitively accepted. His conditions were, a year and a half, till the Easter of 1760, for preparation; and, during this period, the same salary as Von Haven received. These were assented to by Baron von Bernstorf without the slightest hesitation. He now lived solely for his object. He pursued his studies in pure mathematics, perfected himself in drawing, and sought to acquire such historical information, as was attainable with that degree of learning which he had so lately and so imperfectly acquired, without neglecting his more immediate objects. He cultivated practical mechanics, with a view to acquiring greater dexterity in handling his instruments, and in various manual operations, the acquirement and practice of which, in Europe, except for those whose business they are, is but a waste of time. His attention was, however, principally occupied by the private lessons of Michaelis, in the Arabic language, and of Mayer, in astronomy. These he remembered, with very different feelings. For the grammatical study of languages, in general, he had but little talent or inclination; but his lessons in Arabic were rendered peculiarly distasteful to him, by the fact, that, at the end of several months, his teacher had not brought him further than the first fables of Lokmann, and he soon found out that Michaelis possessed no very great store of Arabic philology or learning. He therefore gave up this course of instruction, which Michaelis never forgave him.

Tobias Mayer was undoubtedly one of the first astronomers and mathematicians of his time.* Mayer's zeal for

* The results of his labors were published after his death. They consisted, principally, of a catalogue of 992 stars, and his famous lunar and solar tables. His valuable theory of the moon, and the laborious calculation of these tables, together with the invention of Hadley's quadrant, in 1731, enabled Maskelyne to bring into general use the method of discovering the longitude by observing the distance of the moon from the sun and certain fixed stars, called the lunar method. Mayer died at the early age of thirty-nine, worn out and exhausted by his incessant exertions in the cause of science.

teaching his pupil was as great, as Niebuhr's for learning of him. Among all the men, with whom he became acquainted, in the course of his long life, there was none, whom he so loved and honored as Mayer; and the most intimate friendship subsisted between them. He retained an ardent attachment to Mayer's memory, up to the most advanced age, and fate never procured him any pleasure, so great, as that of hearing that his first lunar observations reached his beloved teacher on his death-bed, before consciousness had left him, and had cheered and animated his last moments; and that these observations had decided the giving the English premium, offered for the discovery of the longitude, to the widow of the man to whom he felt that he was indebted for his acquirements in this branch of science. Mayer, on his part, had no more earnest solicitude, than to educate a pupil who would apply his method of determining the longitude, and his, at that time, unprinted lunar tables, of which Niebuhr made a copy.

He probably saw that blind, mechanical attachment to old ways and prejudices, would for many years retard the reception of his method, but that, when proved by practical application, it would be impossible to stifle it. Mayer interested himself in the outfit for Niebuhr's journey, so entirely as if it had been his own personal affair, that he divided his quadrant with his own hands. The accuracy of this labor of friendship, was proved by the observations which were made with it.

The time appointed for preparation had been prolonged by half a year; and it was not till the Michaelmas of 1760, that he left Göttingen. At Copenhagen, he was most kindly received by the minister Von Bernstorf, and gained his confidence to a greater degree than the other members of the expedition, who were already assembled there before him. As he received a pension from the king, during the time of his preparation, he thought himself bound to purchase all his instruments at his own cost. He esteemed himself most happy to procure them in this manner. Bernstorf, to whose knowledge this accidentally came, pressed upon him compensation for what he had

thus expended, and committed the travelling chest to him, as a proof of respect for his rigid integrity.

He was at this time appointed lieutenant of engineers, a circumstance which only deserves notice, for the sake of a letter which places his modesty and judgement in the most amiable light. "He was," as he wrote to a friend, "led to think of a title for himself, by Von Haven's appointment to a professorship of the University of Copenhagen. A similar one had been offered to him, but he held himself unworthy of it. The one he had received appeared to him more suitable. He might have had that of captain, if he had asked for it; but that, for a young man, would have been too much. As lieutenant, it would be highly creditable to him to make valuable observations; but, as professor, he should feel it disgraceful not to have sufficiently explored the depths of mathematical science." He had at that time no other plan than that of living in his native country, after the accomplishment of his mission, on the pension which was assigned to him.

As more than half a century has elapsed, since the death of his travelling companions, there can be no impropriety in recording what he thought and related of them.

Von Haven's uselessness, as a linguist, has already been mentioned. He had, moreover, chosen a career, for which, on all accounts, no man was less fitted. His sole thought, was, to return home; his favorite topic, was the comfortable life which he there promised himself: no ardor for discovery, or for observation, made him forget the fatigues and privations of the journey, and no one had so many wants, and felt so many privations, as he. A dainty table and good wine, were, in his estimation, the greatest blessings of life; and in Arabia, where the travellers found only scanty fare and bad water, to appease their hunger and thirst, his discontent arose to a despair which often diverted, but sometimes disgusted his companions. He was by nature indolent, and thought himself fully excused from working under such a climate. He likewise frequently showed himself haughty and conceited towards Forskaal and Niebuhr; he behaved as if

he thought himself the highest and most distinguished of the party; and was greatly offended that Niebuhr had the care of the chest. After his death, nothing of the slightest utility was found in his meager journal.

According to Niebuhr's judgement and testimony, Forskaal was by far the most instructed of the party, and had he returned, would have attained to the highest rank among the contemporary men of science, by his manifold and profound acquirements. He had originally studied theology; his eager and free spirit had led him from Sweden to Germany; for a long time, he had devoted himself to speculative metaphysics, with great ardor; he likewise pursued the study of Eastern languages, and at the same time as much of physics and chemistry, as well as of every branch of natural science, as was then known. The metaphysics, of a mind of this stamp, must have been very different from the scholastic pedantry of the time: the academical works, in which he published his speculations on these subjects, passed at Göttingen for odd—in Sweden, for rather bold and flippant; it is matter of regret, that we do not know them. He willingly quitted his country, where, after his return from the university, he met with hostility on every side.

He stood in need of no preparation; the proposal for the journey found him perfectly prepared, and that to a degree in which few ever become so. In laborious industry, contempt of dangers, difficulties, and privations, he resembled Niebuhr. Both felt themselves called upon to observe whatever came before them. Forskaal's learned education, however, gave him a great advantage. He acquired languages, much more rapidly and perfectly, and was soon able to read Arabic works, with fluency. His faults were disputatiousness, caprice, and an irascible temper. Mutual respect and equal zeal, produced a stable friendship between Niebuhr and him; but the harmony between them was not without some interruptions, until Forskaal, on one occasion, discovered that his companion's patience was not completely inexhaustible and impassive. Forskaal's papers have been carefully used by his friend, and what they contained of a narrative

kind, or illustrative of the manners of the people, is inserted in Niebuhr's works with the author's name. Of the edition of his works on natural history, we shall shortly have occasion to speak. It is painful to see how they have been neglected. Besides the systematical descriptions of new plants and their uses, they are rich in admirable observations on vegetable physiology, and in remarks on the husbandry and geological structure of the countries he traversed, particularly of Egypt, of which no such description previously existed. The late Vahl preserved and restored Forskaal's neglected herbarium, so far as it was still possible, and labored to do justice to his memory. Linnæus manifested an odious spirit of hostility to his old pupil. Forskaal had told Niebuhr that he wished one of the species of plants he discovered, (the one called Mimosella, in his Flora,) to be named after himself. Niebuhr transmitted this wish of a man, who had deserved immortality by his labors, to Linnæus; but, instead of paying any attention to it, he gave Forskaal's name to another species, also discovered by him, but which conveyed, by its appellation, the most obvious and malicious allusion to the departed. Niebuhr could never forgive this spiteful trick. Forskaal had also called one species of plants after him, in remembrance, perhaps, of the cordiality with which Niebuhr had assisted in all his excursions and collections. This, however, as he was no botanist, appeared to him inappropriate, and the sole alteration he permitted himself to make, in Forskaal's papers, was, to erase every trace of the honor intended him.

Of the physician, Dr. Cramer, nothing is to be said, except that the choice of him was most unfortunate; that he was incompetent, even in a professional point of view, but still more so, for all the purposes of the expedition. It is to be lamented, that Michaelis's wish to engage Hensler, the father, for the situation, was fruitless. The draughtsman, Bauernfeind, was not a bad artist, but an uneducated and extremely narrow-minded man: love of drinking shortened his life.

The journey began under the most unfavorable auspi-

ces. The party went on board the Greenland, ship of war, which was bound to the Mediterranean to protect vessels, sailing under Danish colors, from English search. The Greenland left the Sound, on the 7th January, 1761. Three times she was driven back to the Elsineur roads; nor was it till the 10th of March, the fourth time of her sailing, that she could continue her course to the Mediterranean.

Niebuhr recollected this voyage with pleasure. The noble and beautiful interior of a ship of war, with all its appointments and regulations, the simple and energetic manliness of the sailors, from the commander to the lowest man on board, a class of men whose distinguishing virtues were very much allied to his own, interested and delighted him, in the highest degree. Nor did he find the way of life monotonous or dull. Navigation was, at that time, very imperfectly understood: its operations were conducted in a manner rather mechanical than scientific. The officers of a ship going on such a service were, however, doubtless, men distinguished in their profession. Niebuhr endeavored to make himself acquainted with the construction of the ship; and he exercised himself daily in nautical and astronomical observations, which procured him the satisfaction of being regarded by the officers as an active and useful member of their company. He thus obtained from them that respect and regard which practical men are always ready to bestow on those, whom they find to be superior to themselves on any particular subject connected with their own business, and whom they see willing to acknowledge their superiority in other points, and able to appreciate their merits and services.*

Mayer, in the instructions he gave Niebuhr, had constantly kept in view that his pupil would be placed in situations in which it would be absolutely necessary for him to be able to rely upon himself, and where he could

* It is a remarkable fact, that, in this same year, 1761, the great astronomer Maskelyne was also at sea, and engaged also in instructing the officers of the ship in which he sailed, in the lunar method, with a view to its general adoption in the English navy, which subsequently took place

not hope for the slightest assistance or support. He had taught him, entirely himself, and encouraged him with the assurance that an active and clear-sighted man is generally able to discover means of overcoming the obstacles which may oppose him. His method of teaching, which was entirely practical, was chiefly this. He first described to his pupil the object of the observation, and the method of using the instruments; he then left him without any assistance, to try how far he could proceed in his observation and calculation, and desired him to tell him when he came to any insurmountable difficulty. He was obliged to describe exactly how far he had gone on well, and where his progress had been stopped; and then Mayer helped him out. He had been able to exercise himself but little, in Göttingen, in calculating lunar distances, and was in great anxiety about his future success in that point. The result of his observations, during this voyage, gave him greater confidence, and ought to have convinced him that he had gone through his apprenticeship, but this his modesty and humility forbade.

A stay of some weeks at Marseilles, and of a shorter time at Malta, procured a very agreeable recreation to the party. The scientific enterprise was known throughout Europe, and we should find it difficult, now, to picture to ourselves the universal interest in its success, which insured to the travellers the most cordial reception and the most respectful attentions. It was an enterprise consonant with the spirit of the times, and nowise solitary or strange. The King of Sardinia had sent the unfortunate Donati to the East: Asia was become an object of interest to Europeans, from the war which the two great maritime powers were then waging in India: England began to send out ships to circumnavigate the globe. It was just that period, of general satisfaction and delight in science and literature, in which mankind believed they had found the road that must inevitably lead to perfection; men of letters enjoyed great consideration; and every body was ashamed not to regard the interests of science and of its followers, as the most important interests of the human race.

In both places, they experienced the courtesy and charm of French reception; for, even in Malta, although the ruling body were of all nations, the prevalent manners were French.

CHAPTER XVI.

LIFE OF NIEBUHR, CONTINUED.

FROM Malta, the expedition proceeded to the Dardanelles, still on board the Greenland, which had taken its convoy to Smyrna. In the Archipelago, Niebuhr was attacked with dysentery, and was near dying. He recovered his health at Constantinople, but so slowly, that, at the expiration of two months after the beginning of his illness, he had scarcely made sufficient progress to go on board a Dolcignote vessel bound for Alexandria, without manifest danger. Here, for the first time, the travellers felt that they were really in the East. The plague broke out among the crowded Asiatic passengers: they, however, were exempt from it.

As we cannot follow him through his minute and accurate descriptions of the places through which he passed, we must content ourselves with a few extracts from his travels, calculated to throw light upon his character; to show that clear and dispassionate judgement, and that freedom from prejudice, which so admirably fitted him for a traveller among people whose opinions and manners are so entirely unlike our own. Passing over his description of Constantinople, we give, in his own words, his account of the first Oriental people with whom he was thrown into close contact:—

"The captain," says he, "his clerk, and his steersman, spoke pretty good Italian. The clerk had been not only in Venice and other Italian ports, but had travelled as far as Vienna. The Roman Catholics had told him just as great calumnies of the other sects of Chris-

tians as the Sunnites relate of all Mohammedans but themselves. I once asked him, whether any heathens were to be found in the Sultan's dominions? In the course of his reply, he said, 'There are many in Germany and Italy; they are called Lutherans, and know nothing of God or the prophets.' In religious disputation, he showed himself a true Mohammedan. One of our company endeavored to convince him of the truth of the Christian religion. The clerk immediately rose, and said, 'that people who believed in other gods beside the one true God, were oxen and asses,' and left the room. The good man thus gave us a hint, that we should do well to leave every body undisturbed in the belief that his own religion is the best, so long as he entertains no doubts about it himself. I did not hold it to be any part of my vocation to make proselytes. But when I afterwards inquired of enlightened Mohammedans, concerning the principles of their faith, I took the opportunity of explaining to them various matters relating to the Christian religion; and, as I carefully abstained from asserting that it was *better* than the doctrines set forth in the Koran, none of them were in the least offended or displeased."

In Egypt, the party remained a whole year, from the end of September, 1761, till the beginning of October, 1762, during which time, Niebuhr visited Mount Sinai, in company with Forskaal and Von Haven. The party did not go further inland than Kahira.* During their stay in Egypt, Niebuhr determined the longitude of Alexandria, Kahira, Raschid, and Damietta, by means of numerous lunar observations, with an accuracy which the astronomers of Bonaparte's expedition, to their great surprise, found fully equal to that of their own. They, and the French army, not only found his chart of the two branches of the Nile equally correct, but even his ground-plan of Kahira, taken under the most difficult circumstances, in the midst of an infuriated and fanatical populace.

"In the year 1801," says his illustrious biographer, "I laid this plan before a French officer who had risen from the ranks during the French revolution,—a man who

* [Cairo.]

could hardly write and was wholly unaccustomed to make use of ground-plans, with a view to gain some information concerning the intrenchments thrown up by the French army round the city, and the history of the great rebellion in Kahira. It was some minutes before he could translate the knowledge he had gained from personal observation into the symbolic language of drawing; but, as soon as he caught the idea, he found his way, step by step, and could not cease wondering. My father, also, measured the height of the pyramids, and copied many hieroglyphic inscriptions on obelisks and sarcophagi."

At the time Niebuhr visited Egypt, very little information, worthy of credit, concerning that remarkable country, existed. Later travellers have added much to what he obtained; but when we consider under what circumstances of difficulty, and with how little protection, he added such vast stores to the stock of knowledge, we shall acknowledge that none have surpassed, or perhaps equalled him in industry, courage, and devotion to his object. Of the obstacles he had to encounter, some idea may be formed, from the following extracts.

At Alexandria, he says, "As I could overlook a great part of the old city walls, from the eminence on which Pompey's pillar stands, I took some angles of it, from there, and hoped that I might be able to take others from some other spot. One of the Turkish merchants, who stood opposite to me, and remarked that I had pointed the telescope attached to my quadrant against the city, was very curious to look through the glass, and not a little uneasy, when he saw a tower upside down. This gave occasion to a rumor, that I was come to Alexandria to turn the whole city topsy turvy. This report reached the governor's house. My janizary refused to accompany me, when I took my instrument, and as I thought a European could not venture to appear in a Turkish city, without a janizary, I gave up all idea of taking any more geometrical measurements here. Once afterwards, when an Arab of Raschid saw a ship upside down in my telescope, he was very near throwing the instrument on

the ground. I learned, by degrees, to be very careful of the Mohammedans and their suspicions, when taking my observations, which was the more necessary so long as I was unable to converse with them."

"At an astronomical observation on the southern point of the Delta, a peasant was present, and behaved very courteously. As I wished to show him something he had never seen before, I placed the telescope of the quadrant opposite to his village, on which he was extremely terrified at seeing all the houses upside down. He asked my servant what could be the cause of this. He replied, that the government was extremely dissatisfied with the inhabitants of that village, and had sent me to overthrow it entirely. The poor peasant was greatly afflicted, and entreated me to wait long enough for him to take his wife, his children, and his cow, to some place of safety. My servant assured him he had two hours good. He immediately ran home, and as soon as the sun had passed the meridian, I took my quadrant on board again. We must not wonder that Mohammedans were suspicious at the sight of these observations, since Europeans enough might have been found, but a short time before, ready to believe every thing enchantment, which they did not understand."

He suggests the expediency of digging round the obelisk at Heliopolis, which, however, he had not the means to attempt. "The common Egyptians," says he, "are very unwilling that the Europeans should dig in the places where antiquities are found, from the idea that we are seeking for treasure. Perhaps, however, they would not forbid it, if the true motive of such researches were explained to the governor of the district, and the work done by his laborers. The peasants of Matare observed me very narrowly while I was measuring the height of the obelisk. They placed themselves at some distance, in consequence of their belief that I should throw up these huge stones into the air by some secret art, and take away the treasures concealed under them. This they were firmly resolved not to allow. They, however, did not speak an uncivil word to me, when they saw that their expectations were not fulfilled."

The following are the circumstances under which the plan of Kahira was taken, to which his son alludes in the passage just quoted.

"With a view," says he, "of giving an accurate description of the size and situation of this city, I have given a plan of Kahira, and the adjacent towns, Bulak, Masr el Atîk, and Djize. This was really so troublesome, and, from the noted insolence of the Kahirians to all people of different religions, so dangerous a task, that no European had hitherto been found to undertake it, or will probably speedily undertake it again. I did, however, venture to measure all the streets, all at least which were thoroughfares, by paces, and to determine their bearings by a little compass. There are many parts, consisting entirely of little streets, which have no egress, and can be entered only from the main street into which they all run. These are inhabited by laboring men and artisans, who, in the Eastern cities, do not work in their houses, but in little stalls or sheds, in the Sûk or market place. As you cannot be supposed to be seeking any man in his dwelling-house, and as it is not the custom in the East to pay your respects to his wife or daughters, the people immediately conclude, if they see a stranger in any of these streets, that he has lost his way, and the first man who meets him, tells him that the street has no outlet at that end, and that he must turn back. It is, therefore, almost impossible for a stranger to obtain any knowledge of these quarters of the town."

One of the most remarkable objects in this city, is the palace of Joseph. "Here," says he, "is manufactured the magnificent cloth, which is yearly sent as an offering to Mecca, by the Sultan. The building still retains traces of its former splendor. In the room, in which the weavers sit, the walls are covered with trees, houses, &c., in the most beautiful mosaic of mother-of-pearl, small stones of every variety, and colored glass. On the walls of another room, in which the cloth is embroidered, are some inscriptions, in very good preservation. In a third, the ceiling is very beautifully painted. Above, on the side of the Kara Meidân, where this great building is sup-

ported by a very high wall, springing from a steep rock, is a point commanding a magnificent view of the town, the surrounding country, and the pyramids. Some of the names of former regents of Egypt are engraved here. It appears that it was the residence of the Egyptian Caliphs and Sultans, and I could not help wondering, that the Turkish governors do not inhabit it. I asked the overseer of the weavers, who not only conducted me about the building, but took me to his house and entertained me with coffee, after what Joseph this palace and a fountain in the city were named? He was of opinion that the palace was not more than 600 years old, and was built by Salaheddin, whose original name was Jusof."

Niebuhr's account of one of the most interesting phenomena in the world, the overflow of the Nile, is so curious, that we may be allowed to interrupt the course of our narrative a little longer, to insert it.

"When the Nile begins to rise, all the small canals which are led off from the main stream to water the adjacent fields, are stopped up and cleaned, and remain in that state until the water reaches a certain height. This height is ascertained by a Nilometer, on the island Rodda. For this purpose, a Sheikh is stationed there, who, as soon as he perceives that the water has risen at all, gives information of it. A number of poor people, who are already in waiting at Masr el Atîk, or Fostat, immediately hasten to Kahira, and each spreads the welcome intelligence through the streets of his own quarter. From this time, these people come daily at a certain hour to Fostat, and the Sheikh calls out to them from the islands, how many inches the Nile has risen.

"This is daily made public, until the Nile has reached the height at which it is appointed that the canal which runs through Kahira should be opened, at which time, the tribute to the Sultan must be paid, and all anxiety about a scarcity is at an end. The information, however, thus proclaimed, is very little to be trusted. The Sheikh goes alone to the Nilometer, and always, at first, declares the height less than it really is; so that if, at a later period, the water should increase but little for some days,

he may then be able to declare the rise greater than it is, in order not to alarm the inhabitants with the fear that the Nile should not reach the desired height. About the time when it was hoped the canal through Kahira would be opened, I sometimes went myself towards the mouth of the canal, to observe the height of the water against a high wall, and I discovered that the rise which was proclaimed in the city was three times as great as I had found it to be. In the year when I was in Egypt, it was first proclaimed that the Nile had begun to rise on the 29th of June, and, on the 8th of August, that it had reached the height of sixteen Drâ or ells. Hereupon, the dam of the canal of Kahira was cut through with the customary ceremonies, which have often been described. We expected the water in the city, but in vain; for the canal had been so imperfectly cleaned that year, that it was not till the 10th that we saw a little water, whereas we ought to have been able to navigate the canal the first day. This extraordinary event, caused a great agitation among the people. It was openly said, that the person who had undertaken to clean the canal would lose his head. He, however, paid a large sum to the government, and was compelled to make a new dam at his own expense, which was thrown across the canal on the 11th of August, and opened, without any ceremony, on the 12th.

"Gabriel Zionita, in his appendix to the description of Africa by the Sherif Edrîsi, mentions, as very extraordinary, that the Egyptians have certain tests, by which they can ascertain, beforehand, how high the Nile will rise, and whether they may expect a plentiful or a scarce season. This, indeed, they think so easy a matter, that almost every Egyptian woman, whether Christian or Mohammedan, imagines herself competent to it. It is the universal opinion in Egypt, that the Nile begins to rise in Habbesh, (commonly called Abyssinia,) on the night of the 17th of June; or, as they express it, that the drop (Nokka) which causes the rise of the Nile, falls. On that night, therefore, the women put a certain quantity of dough, on the roofs of their houses, and if this has not increased in weight by the morning, *the drop* has not fall-

en. But, if the dough is heavier, it has fallen, and they then proceed to calculate with certainty how many feet the Nile will rise, and what will be the price of corn for the year. As the weather is very regular and uniform in Egypt, it is possible that there is a heavier dew at this season of the year; and as the women never put out their dough except just on the night above-mentioned, they are always confirmed in their faith in the certainty of their test. As some of the Kahirians reckon time according to the Koptish calendar, the women were not all agreed on which night *the drop* fell. Other experiments of the same kind are yearly made, but intelligent Mohammedans regard the whole thing as mere pastime for the women."

Niebuhr's accounts of the agriculture, the products, the implements and machinery, the trade and manufactures, the dress, manners, and amusements of the Egyptians, are full of interesting, clear, and accurate detail, and are, above all, marked by that perfect fairness and anxiety in no degree to exceed or warp the truth, which was, perhaps, his most striking characteristic.

In October, the party set sail from Suez, on board a Turkish vessel; they landed at Djidda, and reached Loheia, the first point of their proper destination—the country of Yemen—at the end of the year 1762. On this journey, Niebuhr made astronomical, geographical, and geodætical* observations, as often as possible, and made some inquiries respecting the currents. Out of these laborious investigations, grew the chart of the Red Sea, which, with reference to the circumstances under which it was made, and the means at his disposal, may be regarded as a masterly work.

After some stay in this agreeable town, the party, especially Forskaal and Niebuhr, travelled through western Yemen, in various directions; the former botanizing, the latter ascertaining the geographical situation of places. They then returned to the seacoast to Mokha, where Von Haven died, about the end of May, 1763.

At the same time, Niebuhr was again attacked by dys-

* [Pertaining to the art of measuring surfaces.]

entery, and was only saved by the greatest care and temperance. After many delays and difficulties, and before he was perfectly recovered, he set out, undismayed by the danger he ran, with the rest of the party, for the capital, Sana. The climate, and numerous annoyances, which Forskaal had partly brought upon himself, partly aggravated through his caprice, brought on a bilious disorder, of which he died at Jerim, on the 11th of July, 1763.

Niebuhr was the more depressed at his loss, from his own protracted illness. He set out, with the two survivors, on the road to Sana, but without the slightest hope of returning, and fearful that no precautions could insure those papers which were not left in the care of his English friends at Mokha, reaching Europe. This was a source of much greater anxiety to him than his life, to which he never held with any very great eagerness. He feared the entire frustration of the object, and, with good reason, that injustice which might be done to his and Forskaal's discharge of their duties. This was the only point of time, during his whole expedition, at which his spirits completely sunk.

At length, he found himself in that state of dull resignation, into which Europeans in the torrid zone generally sink, when under the influence of sickness and depression. He, who, both earlier and later in his journey, struck into the most toilsome path, on the slightest rumor of an inscription or a ruin, could not now be stimulated to quit the high road to copy the Hamjarish inscriptions at Hoddafa;—an omission for which any one, who imagines himself in his place, will easily excuse him; but for which he used bitterly to reproach himself, after a lapse of fifty years.

From the same causes, the survivors declined the cordial and friendly invitation they received to pass a whole year in Sana and Upper Yemen; which would have been quite agreeable to the original plan. They hastened, on the contrary, to reach the coast, before the English ships sailed. Their haste was much too great, for they had to wait the whole month of August, and more, before the vessel in which they were to sail was ready. Mokha,

situated in the arid desert of Tehama, is, during summer, a horrible residence, and but few days elapsed, before the surviving travellers and their servant were attacked with the fever of the climate.

Bauernfeind and the servant died at sea. Cramer reached Bombay, languished for some months, and died. Niebuhr was saved by that extreme abstemiousness, which renders a tropical climate as little dangerous to Europeans as to natives. While he was laboring under the dysentery, the physician had told him to abstain from meat, and to eat nothing but bread and a sort of rice soup. This regimen cured his illness. At the end of several weeks, the physician learnt, with astonishment, that Niebuhr was patiently continuing a diet, by means of which few Europeans could be induced to purchase their lives, even when laboring under dangerous illness.

The merchant, to whom the ship which conveyed Niebuhr from Mokha to Bombay belonged, was Francis Scott, a younger son of the Scotts of Harden, a Jacobite family of Roxburghshire. He became his intimate friend. "Five and thirty years afterwards," says his son, "when I studied in Edinburgh, I was received, in all respects, as one of the family, in the house of this venerable man, who then lived at his ease in the Scottish capital, on the fortune he had acquired by honorable industry."

At Bombay, Niebuhr learned the English language. He also endeavored to acquire all the information possible from the Parsees and Hindoos, visited the excavated pagodas of Elephanta, and made drawings of the sculptures.

Lastly, he employed himself in arranging his journal, and sent a copy of it, through London, to Denmark. He also made use of an opportunity to visit Surat.

It was originally settled, that the travellers should return by India: when, however, the inclinations which had first prompted Niebuhr to undertake the journey, had returned in full force, with the return of health, this plan displeased him and he determined to make his way back overland. To achieve this, he was obliged to relax a little from the intense and wearing application to his original pursuit.

From the time he quitted Bombay, where he learnt the death of his friend Mayer, (without whose examination and sanction, he did not dare to trust himself, as he might and ought,) he gave up his observations for the longitude; to which he was further induced, by the death of his Swedish servant, whom he had taught to assist him in the mechanical part of the observations. This is greatly to be regretted, for Persia and Turkey in Asia still present a wide and untrodden field, for observations of this kind. Those who saw what pain this gave him in his old age, rather felt inclined to love and admire his zeal and modesty, than to lament the omission of a work he so much desired to perform.

In December, 1764, after a stay of fourteen months, Niebuhr quitted Bombay, visited Mascat, and made himself acquainted with the state of the remarkable province of Oman. He, however, did not remain there long, but went by Abusheher and Shiraz to Persepolis.

The drawings of the ruins, inscriptions, and bas-reliefs of Persepolis, made by three preceding travellers, had forcibly drawn Niebuhr's attention to them, as the most remarkable monument of eastern antiquity: no other, either in Asia or in Egypt, awakened such well-grounded hopes of being able to understand and interpret historical records by a discovery of the meaning conveyed in the symbolical sculptures; and his acute and experienced eye immediately taught him the incompleteness of all the existing drawings. Nothing of all that he had seen in Asia raised his expectations to such a pitch; he could not rest, till he reached Persepolis, and the last night of his journey thither was perfectly sleepless. The picture of these ruins, remained during his whole life indelibly engraven on his mind—they appeared to him the crown and glory of all he had seen.

He passed between three and four weeks amidst them, in the desert, in unremitting labor, measuring and drawing the fragments. The inscriptions on the walls, which were at a considerable height, were distinctly legible only when the sun shone upon them; and as in this climate the hard polished black marble is not corroded by weath-

er, his eyes, already greatly enfeebled by incessant labor, were attacked by a very dangerous inflammation. This, joined to the death of his Armenian servant, compelled him, in spite of his strenuous resistance to these complicated difficulties, to abandon the ancient sanctuary of Persia before he had thoroughly exhausted its treasures.

He returned by way of Shiraz and Abusheher, and thence across the Persian gulf to Bassora. In Persia, he collected historical documents concerning the fate of this unfortunate country, from the death of Nadir Shah up to his own times. With these he conferred a value, little known, on the German translation of Jones's History of Nadir Shah, the original of which was written in French. The information concerning that period furnished either by Oliver, or by Sir John Malcolm, is not (to use the most modest language) more valuable, than that for which we are indebted to him.

In November, 1765, he went from Bassora through Meshed Ali and Meshed Hussein, two places of resort for pilgrims, but hitherto unvisited by any European, to Bagdad, and thence through Mosul and Diarbekr to Haleb, where he arrived on the 6th of June, 1766. He was now perfectly at home: since he had been alone, he had been at liberty to conform, without molestation, to Oriental manners and customs. He was, moreover, now living in a perfectly healthy country, and was as well as at any period of his life.

During this year and a half, he had had scarcely any intercourse with Europeans, except at the remarkable Dutch establishment at Karek. In many of the large Turkish cities he visited, were convents of Roman Catholic missionaries; these men he regarded with the utmost aversion, as disturbers of the tranquillity of the unfortunate native Christians, and of course shunned them. That among these missionaries, by far the greater number of whom were quarrelsome, malignant, and ignorant, there were some scattered instances of such sanctity of life as is rarely to be met with in any other class of men, he bore ready testimony. At Bagdad, he had become acquainted with Father Angelo, who had nursed many

thousand people, of every nation and religion, in the plague, and whose life had been saved by a crisis, which, to pious minds, appeared miraculous, when he was himself attacked by that frightful disease.

At Haleb, however, he found himself in a numerous society of consuls and merchants of all the nations of Europe, in consequence of the profound peace, living in undisturbed harmony. Some of them were married, and their houses afforded the charm of European domestic life, under the directing hand of woman.

His dearest and most intimate connexions, were here, also, with Englishmen. Here he became acquainted with Dr. Patrick Russel, the author of the work on the Plague, and editor of his uncle Alexander's Description of Aleppo. "This respected friend of my father," says Mr. B. L. Niebuhr, "I had also the satisfaction of knowing, many years afterwards, and of hearing from him many histories of by-gone days, told with a heart overflowing with the warmest affection and veneration."

Count Bernstorf had very readily consented to the extension of Niebuhr's journey. When this became generally known, the Count was solicited to allow him to visit Cyprus, for the purpose of copying again the Phœnician inscriptions at Citium, which might be supposed to be at least as incorrectly copied by Pococke as the Greek ones which he has given. He found no such inscriptions; and was inclined to suspect that those in question were only old Armenian inscriptions, (like some which he himself met with at Saline near Larnica,) badly copied by Pococke. It appears more probable that the stones had, in the interval, been removed.

An opportunity of going to Jaffa tempted him to visit Palestine, the geography of which was entirely undetermined by any astronomical observations, while no authentic ground-plan existed, of the topography of Jerusalem. In this, he had made as much progress as the time permitted, in the beginning of August, 1766, when he retraced his steps to Jaffa, made an excursion from Sidon over Mount Lebanon to Damascus, and then returned to Haleb.

Five months and a half after his first arrival at Haleb, on the 20th of November, 1766, he set out to return directly home. He went with a caravan as far as Brusa. Lesser Asia, the land on the coast lying open to the south, excepted, is very cold in winter; and on the table-land of Mount Taurus, our traveller suffered as much from frost, piercing winds, and snow drifts, as he could have done in a winter journey in northern regions. In the warm and beautiful Brusa, he enjoyed a repose from this suffering, to which he had long been a stranger, employing his leisure, as usual, in working at his journal and charts. He reached Constantinople, on the 20th of February, 1767.

He passed between three and four months, in the capital of the Turkish empire, with which, six years before, sick and a stranger in the East, he had been able to make himself but imperfectly acquainted. He had now seen many Turkish provinces, and knew their institutions, and the revolutions which had taken place in them. In the capital, he sought and gained information as to the general government and military establishments of the whole empire. His treatises on these subjects, remarkable for their solidity and completeness, are printed. Turkey in Europe can furnish attractive occupation, only to scholars, to whom it is not Turkey, but Greece and Macedonia, and whose eye and imagination are ever in search of vestiges of past glory and greatness. Niebuhr travelled rapidly, through insecure and almost impracticable roads, to the Danube, and but little more slowly through Wallachia and Moldavia, in the capital of which latter, the plague was then raging. About the middle of July, he once more set foot on Christian ground at Zwanick.

King Stanislaus Poniatowsky, a man of refined and literary tastes, and imbued, in the highest degree, with that veneration for knowledge and science, which characterized his age, had made known to the Danish government his wish, that Niebuhr should direct his course homeward through Poland. He received the distinguished traveller, with the manners of a polished gentleman, who takes the utmost care that his guest should not feel

that he was invited as a curiosity. He effectually succeeded in winning our traveller's heart; and for many years, a correspondence was carried on between them. Niebuhr, who had been so long without any intelligence from Europe, and knew nothing of what had been going on, there, when civil war broke out in Poland, regarded the confederates as rebels, and his royal friend as a persecuted, but legitimate and excellent monarch.

On the way from Warsaw, he visited Göttingen, and his beloved native place, where the death of his mother's brother, during his absence, had left him in possession of a considerable marsh-farm. He reached Copenhagen, in November, and was received by the court, the ministers, and men of science, with the greatest distinction. Count Bernstorf, who knew how to appreciate him, in every respect, and who, moreover, considered his own honor, as projector of the expedition, implicated in the manner in which it was achieved, appeared to wish to prove his gratitude to him, by the most friendly and cordial reception. Niebuhr was intimately acquainted with him, and through him with his immortal nephew, the second Count, and with the Dowager Countess Stollberg, and her sons, then boys.

Klopstock, and the domestic friends of the minister, were also in habits of intimacy with him. His own dearest and most confidential friends, were Professor Krazenstein and his excellent wife.

His first business, was, to submit his accounts for inspection. From these, he could not himself ascertain the whole cost of the expedition, since they did not include all the preparatory expenses; and it appears, that he had neglected to procure for himself a copy of the general account. None at least was found among his papers, and he quotes another authority, to prove that the whole expedition cost only 21,000 reichsthalers—(£3,780 sterling.) We recollect having heard another sum stated at Copenhagen, but it was very little higher; probably some information on the subject may be found in the Kiel journals of the time. The expense, on any calculation, was so extremely small, as to excite the

greatest astonishment. It would necessarily have been much greater, had not Niebuhr been the sole survivor, for nearly the whole of the last four years; but, although the sources of expense were thus greatly diminished, they were still more so, by his scrupulous integrity;—not only in avoiding every outlay not essential to the object, but in paying out of his private pocket, for every thing which could be regarded as a personal expense.

"A far heavier account," says he, in the notes of his life which he wrote for his immediate friends, "was that which I had now to render to the public, concerning my travels." The materials in his journal and papers were extraordinarily rich and various. That he now labored at their arrangement and completion, with all the truth and simplicity natural to him, will readily be believed; his distrust of his ability, however, amounted almost to despondency. We have already seen how he had grown up to manhood, almost entirely without acquaintance with literary pursuits; nor was this all: he had read little, connectedly, especially in German. The high German, or written language of Germany, was not his mother tongue; it was only as a young man that he had familiarized himself with it, nor was he ever master of it, in all its extent and richness. But he was still more afraid, lest, from want of learning, he should state facts in an erroneous or incongruous manner, and consequently be misunderstood and unfairly judged.

His first notion, was, to publish two works, before he published his travels; the one consisting of replies to the queries addressed to the members of the expedition, to be extracted from his own and Forskaal's papers, the other of a collection of all his astronomical observations.

It might certainly have been expected that some queries would have been digested, and given to men, whom Michaelis was sending to explore new countries, and that a solution of them would have been demanded. So far, however, was this from being the case, that more than four years after the first conception of the project, when the expedition sailed from Copenhagen, he had prepared

only two very insignificant questions; the remainder they received, at three several times, on the journey.

Incomparably more important than any of these, was the paper containing topics of inquiry, concerning the history of Yemen, compiled by the *Académie des Inscriptions et Belles Lettres*, with that true Oriental erudition, for which France had long been distinguished. A translation of them is to be found in Niebuhr's works, after the queries of Michaelis. As the latter are well known, the public can judge whether they deserved answers, and whether it was possible to answer such questions satisfactorily. The philologist of the expedition was, at all events, totally incompetent to the investigation; it was Forskaal, indeed, who took it upon himself, and who, from the diversity of his talents and knowledge, was the only person at all fitted to it. As long as he lived, Niebuhr, who understood nothing of Hebrew, regarded these inquiries as only indirectly connected with his pursuits; though, indeed, he neglected nothing which could be of the slightest utility to science. When, however, he remained the solitary survivor, he spared no labor in collecting answers to the queries. He thus fulfilled, to the utmost extent, all that could be required of him. To him, what was accomplished, appeared very little, and the extreme modesty of the expressions in his preface, ought to have disarmed even such enmity, as that displayed in the attack upon him in Michaelis's biography.

As he now thought, and with justice, that these answers were too insignificant to form a work distinct from his great one, there were other causes which decided him not to publish the astronomical observations, separately.

His fears, concerning the accuracy of his lunar observations, and the calculations founded upon them, have already been mentioned. Had Mayer lived, he would have examined them, and, once assured of their accuracy, by him, Niebuhr would certainly have published them with perfect confidence. He, however, could now find nobody on the continent, who was master of Mayer's

method, and willing and able to tranquillize his fears and encourage his diffidence, by examining them.

It was, also, a most adverse circumstance for him, that Father Hell, who had been sent to Wardöhuus to observe the transit of Venus, in 1769, was then staying in Copenhagen. Father Hell was unquestionably an able astronomer, but prone to depreciate and to thwart the works of all other men. This accounts for his having taken pains to decry the quadrant which Niebuhr had constantly and most ably used, as an imperfect instrument;—a matter upon which he completely altered his tone when he took this very instrument with him to Norway. He was a declared enemy to Mayer's method; and as Niebuhr, with all the humility natural to him, acknowledged his superiority as a scientific astronomer, Father Hell took advantage of this, to increase his diffidence as to the value of his observations, and to maintain that the only certain method of ascertaining the longitude was by the eclipses of Jupiter's satellites. Niebuhr had also made some observations of these eclipses. The scientific readers of his travels, will recollect that the longitude of Loheia is determined by them, and that he ascribed the calculation to Father Hell. The impression which the crafty Jesuit made upon his mind, with respect to his lunar observations, was in the highest degree unfortunate. He had not, indeed, lost his own faith in his observations, but he now feared doubly for the reception they would meet with from the public, and thought he should be compelled to abandon them, until somebody should be found who would examine and verify them. This was afterwards done by Bürg.

He now came to the resolution to work up his materials in the form in which they afterwards appeared. For the publication of these two works, Bernstorf procured him very liberal support from the Danish government. All the copper-plates were executed at its cost, and given to Niebuhr. The rest of the expenses he defrayed, having adopted the unfortunate plan, of publishing the works himself.

While he was occupied in preparing his 'Description of

Arabia,' the political circumstances of Denmark changed, in a manner the most painful to him. Struensee had got possession of the government, and even of absolute power, and Count Bernstorf was dismissed. Niebuhr did not think fit to take upon himself the character of a public man; his desire on this, as on other occasions, was not to be conspicuous; but he was far from disowning his warm attachment to Bernstorf, at a time when all the timid fell off from the discarded minister: Niebuhr, with a very small number of faithful friends, accompanied him to Roeskilde. He never deigned to pay a visit to Struensee, nor would he appear in any place where he was likely to meet the mischievous despots of that unparalleled epoch. He spoke his mind freely; he rejoiced when the people rose against the enemies of their country, and shared the triumph of their downfall.

The 'Description of Arabia' appeared at Michaelmas, 1772. A book of this kind could not become popular; it was, indeed, fitted only for the few. It is, however, difficult to understand how a critic could be found with effrontery enough to write such a review of a book, so truly classical, so full of information, and, at the same time, of modesty, as that which appeared in the Lemgo Scientific Journal. It was manifestly dictated by a desire, not to enlighten the public, but to destroy the book. Personal hostility had blinded the writer, or envenomed his mind; he, however, attained his end—he deeply wounded an unpractised author, whom the cool reception of the public had already sufficiently discouraged.

Niebuhr expected that his work would excite a more lively interest abroad, than in Denmark; and the appearance of the French edition, which he published the following year, seemed well calculated to realize his expectations. In publishing this, however, two great errors were committed, which increased the influence of the adverse star that presided over all his literary undertakings. The translation ought to have appeared, at the same time with the original. Time had now been given for a Dutch publisher to make the same speculation, and the two translations came out, at the same time. But however bad

and impure was the French of Holland, and to however small a portion of praise the translation which appeared there, is entitled, it unfortunately happened, that the one made at Copenhagen, by a refugee priest, was much worse. So utterly unreadable, indeed, was it, that nothing but its novelty, could have procured it any notice, whatever. Niebuhr, who understood only just so much of the language as was necessary to make himself understood, was unhappily no judge of this, and threw away all the money this abortive undertaking cost him.

At this time, a sort of diplomatic messenger, sent to several of the northern courts of Europe, by the Pasha of Tripoli, arrived at Copenhagen. His name was Abderrahman Aga. The object of his mission, was, to beg those presents for his master, which the feeble government of Tripoli had no longer power to extort. It was also a favor conferred upon the ambassador, who was entertained at the cost of the courts he visited, and received presents for himself. The Danish ministry had assigned him a man as companion and attendant, who had formerly been consul in Barbary, and was supposed, of course, to understand Arabic. The Tripolitan, who was a very intelligent man, found him extremely dull, and almost entirely ignorant of the language he was employed to interpret. Niebuhr, who cherished the feelings of a countryman towards all Orientals, visited Abderrahman. He was delighted with an opportunity of speaking and hearing Arabic, of reviving his already diminished facility in it, and of gaining, from a native, information concerning the regions, where that language is spoken, which he had not visited. From him also he gained much interesting intelligence of Tripoli and Barbary. The details which he gathered concerning middle Africa, were of a much more important kind; and are the first, calculated to throw any light on those unexplored regions, collected since the time of Johannes Leo Africanus.

Abderrahman Aga visited many of the countries and capitals of Europe, but Niebuhr was the only man, then to be found, who knew how to turn this opportunity to the account of science. His testimony was most valua-

ble. He had not, indeed, crossed the Sahara, or visited Negroland, but he traded thither; and, besides the interest which he took in the country, as a merchant, he had that ardor for geographical research, which is very extensively diffused among the nations of the East, and is promoted by the paucity of their subjects of conversation. He likewise had some knowledge of the Negro languages: from him, and from one of his black servants, Niebuhr collected various specimens of these dialects.

The discovery of two great Mohammedan and civilized kingdoms in central Africa; the Tripolitan's assurance that a traveller, sufficiently acquainted with Eastern manners and customs, to pass as an Asiatic, would meet with no greater difficulties there than in Arabia, and with less fanaticism than in Egypt; the undoubted good faith and cordiality of Abderrahman's invitation, and of his promise of all possible recommendations and assistance; the consciousness of the knowledge, aptitude, and familiarity, which he had acquired, joined to that longing after the deep and solemn tranquillity of Eastern lands, which other Europeans who have been long resident in them have felt; —all these causes united, awakened in his mind so intense a desire to travel, by way of Tripoli and Fezzan, to the Niger, that he would probably have set out at his own expense, without any assistance from the government, had he not been withheld, by the duty of first finishing the account of his travels. Whatever were the countless dangers which threatened him, we are justified in believing, that in all human probability he would have surmounted them. The Moorish merchants, who, through the first injudicious visits of the English expedition, became suspicious and jealous, would have received him, without any hostile feelings, and for the difficulties of the journey, he was as well prepared as an Asiatic. His talents and fitness for the undertaking were too peculiar and remarkable, and too thoroughly tried, not to promise him results greater than those which any other traveller, excepting only Brown, could expect.

But the course of his life was now to be changed. Had he remained single, he would have hastened to finish

his work, in order to attempt this attractive adventure; but at this very time, he became acquainted with the daughter of the deceased physician, Blumenberg, a Thuringian, and was soon betrothed to her. This was his first and only love; and that it was deep and strong, is sufficiently proved, by his sacrificing to it, the journey of discovery, which he had so passionately desired, and the Oriental life, which was so agreeable to him. He married, in 1773. His wife bore him two children,—a daughter, and B. G. Niebuhr, the illustrious author of the most learned and valuable researches into the history of Rome, which have ever appeared, from whose life of his father, this memoir is chiefly taken.

The first volume of his travels appeared at the Easter fair, of the following year, 1774. This caused him to visit the fair; but, even had he not been led to Leipzig, by business, he would have been induced to go, by his desire to become personally known to Reiske. If any man, in Germany, ever experienced the misery of persecuted excellence, it was Reiske, whose contemporaries could not but admit, that if any imperfection now and then appeared in his learning, it arose only from the extent and fulness of his genius and imagination; and that what was ill-natured and unamiable in his writings, was the offspring of his bitter feelings, at being trodden underfoot, by the tyranny of literary envy. "It is not without pride," says Mr. Niebuhr, "that I affirm, that my father and Lessing were the only men who did honor to him while living: my father publicly bore testimony, that, even among the Arabs themselves, he had never met with a man, so profoundly versed in their literature."

In spite of the very unfavorable experience he had already had, of publishing on his own account, he held himself bound, by a sacred duty to his departed friend, to publish Forskaal's works on natural history. This acquittal of a debt to friendship, occasioned him a greater loss, than all his other publications, from the unavoidably small sale of the work. It was impossible to print from manuscripts, in so confused a state, nor could Niebuhr undertake to arrange them, totally unacquainted as he was,

with the natural sciences, and little versed in the Latin language. He intrusted the task to a Swedish man of letters, and paid him a very considerable sum for its execution. This Swede was a strange man, and, among other things, importuned Niebuhr to let the preface appear in his name; his compliance with which, was afterwards a cause of great regret to him. The extraordinary value of this neglected and forgotten work has been mentioned.

Already discouraged by the very considerable sums he had either wholly sunk, or, at least, locked up for a long time, in his literary undertakings, he delayed the publication of the second volume of his Travels, which did not appear till 1778. According to his original plan, this ought to have come down to the termination of his expedition; he broke off, however, at his arrival at Haleb. The remainder of the journey, together with remarks on the Turkish empire, on the Mohammedan religion, details concerning Abyssinia, which he had collected at Yemen, and those relating to Sudan, which he had obtained from Abderrahman Aga; lastly, the whole of his astronomical observations, were to compose the third volume, which he then thought would very soon follow the others, but which never appeared, though he was so often and so earnestly urged to publish it, by his friends and admirers. The causes which hindered his complying with their wishes, will be stated in the sequel of this narrative.

He lived very contentedly, at Copenhagen, in the bosom of his family, and of a small circle of friends; but the loss which he sustained, from the retirement of Count Bernstorf, was never supplied. Misunderstandings and differences some time afterwards troubled his outward comfort; and as he easily took a disgust at a place of residence, in which he had experienced vexations, he began to grow averse to this city, although he had lived happily in it for ten years, particularly as he heard that General Huth intended to send him into Norway, on a geographical survey of that country. This mission was extremely distasteful to him; he did not like to be separated from his family, and he could not take them with

him into the wild mountains of Norway. He therefore endeavored to quit the military service, and to obtain a post in the civil service of Holstein. The government acceded to his wishes, and gave him the situation of secretary of the district, at Meldorf; an office, the duties of which were not, at that time, very burdensome. In the summer of 1778, he arrived, with his family, at that place, in which he remained till his death.

Meldorf, the chief town of the old republic of Ditmarschen, formerly rich and populous, is sunk into obscurity and desolation. It was twice taken, plundered, and burnt, both in the successful war of subjugation, and in that of vengeance and liberation, which followed it. This, added to the grievous contributions extorted from it, in the thirty years' war, and the famine which arose out of the universal decay in which the country languished, from the year 1628, till the rise of the price of corn in 1790, completed its ruin. Numerous vestiges of the good old times are, to those acquainted with its history, melancholy memorials of its lost and irrecoverable prosperity. Quiet and deserted as the place was, it may readily be supposed, that it was entirely without the sort of society suited to a man of Niebuhr's tastes and character; for he was, unfortunately, little versed in the learned languages, and he remained a stranger to the excellent man who is still the ornament of the place, until he became indebted to him for the philological education of his son.

Meanwhile he settled his plan of life, built himself a house, the massive style of which, showed his love for the plain and substantial dwellings of his fathers, and planted a garden, the fruit of which, he was, at that time, in too delicate health, to hope to gather. He, however, outlived most of the trees in it. In these employments, and the acquisition of knowledge of the country, several years slipped away, during which he began to lose sight of the termination of his work; indeed, this daily became a source of increased pain and mortification to him, from an increasing perception of the pecuniary loss it had caused him, and from the great indifference to it, which then prevailed in Germany.

At this time, too, he sustained a loss, which rendered him, as father of a family, more thoughtful as to the sacrifice of a part of his remaining property, for so unthankful an undertaking. He was tempted to buy shares in a joint-stock undertaking, and wait for a higher premium, till they reached a price for which there was no foundation; this ended in their sudden fall, and in the loss of the holders.

CHAPTER XVII.

LIFE OF NIEBUHR, CONCLUDED.—BELZONI.—CONCLUSION.

MANY things now conspired to trouble his tranquillity. He, himself, as a native marshman, enjoyed very good health in the air of Ditmarschen; but his wife, like all strangers, had to struggle against continual attacks of fever, and her delicate constitution was thoroughly shaken. Niebuhr had employed himself, for many years, though of late with considerable interruptions, in arranging and preparing his works. He now entirely laid them aside. With the same view, he had read a great deal; he was now in a place in which no book ever met his eye, which he did not himself procure. The void which this occasioned, was extremely oppressive to him, and disheartened and indisposed him for his labor; the more so, as the dead stagnation of a place, in which no day was ever marked by a new occurrence, was contrary to his nature, to that impulse which had driven him out into the wide world, and to the very varied and eventful life to which he had been accustomed. The void, indeed, which he felt, was one which no books could fill; and, as he did not clearly define it to himself, it hung upon his spirits, as a silent discontent. The direction of his mind was exclusively towards the historical knowledge of things, which form a part of the existing and visible earth. Even the history of the past ages of the human race, was for him a merely subordinate study. From the same peculiar

character of his mind, even astronomy, his own proper pursuit, had no charms for him, except as serving to illustrate geography. When he built his house, he had fitted up a room as an observatory, and made observations there, and in other parts of Holstein, for the sake of ascertaining the situations of places: latterly, however, he discontinued this, more and more, and the instruments he had used on his travels, were preserved only as relics.

It was a most fortunate and beneficial thing for him, that, a few years after he settled at Meldorf, Boie was sent thither, as governor of the province. The editor of the 'Deutches Museum' had, of course, very extensive literary connexions, and the intercourse between men of letters, was then carried on with a vivacity and interest now wholly unknown. On every account, therefore, he was capable of furnishing various interesting matter, about which Niebuhr's mind busied itself. An intimate and daily intercourse, which formed part of the regular routine of their lives, accordingly arose between these two men, and, when Boie married, between the two families.

Through Boie's means, Niebuhr also became acquainted with men, who would otherwise never have visited this remote and obscure corner. In this manner, he obtained the acquaintance and the friendship of the celebrated poet and scholar, Voss.

Another, and not less considerable advantage, which arose out of Boie's residence at Meldorf, was, that he possessed a very fine library, which, as editor of the 'Museum,' he was continually increasing. The greater part of the books were, it is true, foreign to Niebuhr's tastes and pursuits, but there were many, which interested and occupied him.

One consequence of this connexion was, that he was stimulated to write many papers, which circumstances called forth, for the 'Museum;' and to give treatises to that periodical, which had been intended to form part of his third volume, and were laid on the shelf. This was, in more than one way, disadvantageous to him. It tended to extinguish all purpose of publishing the deficient vol-

ume; it dissolved the connexion in the matter and destroyed its integrity; and was so much given away, out of the newest and most important parts. He seldom wrote for the press without constraint, or without dread of committing errors in style. This anxiety was greatly increased, by Boie's fastidious criticism. Niebuhr gave him his manuscript to read through, as he had been in the habit of doing, to a friend in Copenhagen. He was not, however, content with erasing a few obvious errors, but corrected it throughout with such rhetorical nicety, that Niebuhr was now more than ever convinced of his entire inability to write. In this, he was quite wrong; for the style of those of his essays which had not been touched by any other hand, not only characteristically expresses his peculiar modes of thinking, but is remarkable for the simple beauty it derives from the Low German idioms, which sometimes appear faintly, sometimes in undisguised and primitive plainness. To Northern Germans, they have a peculiar charm, and none but a taste, enfeebled and depraved by fastidious refinement, could ever take offence at them.

Meanwhile, his children grew to an age to require instruction. This he gave them, himself. "He instructed both of us," (says his son,) "in geography, and related to us many passages of history. He taught me English and French—better, at any rate, than they would have been taught by any body else in such a place; and something of mathematics, in which he would have proceeded much further, had not want of zeal and desire in me unfortunately destroyed all his pleasure in the occupation. One thing indeed, was characteristic of his whole system of teaching:—as he had no idea how any body could have knowledge of any kind placed before him, and not seize it with the greatest delight and avidity, and hold to it with the steadiest perseverance, he became disinclined to teach, whenever we appeared inattentive or reluctant to learn. As the first instructions I received in Latin, before I had the good fortune to become a scholar of the learned and excellent Jager, were very defective, he helped me, and read with me Cæsar's

Commentaries. Here, again, the peculiar bent of his mind showed itself;—he always called my attention much more strongly to the geography than the history. The map of ancient Gaul, by D'Anville, for whom he had the greatest reverence, always lay before us. I was obliged to look out every place, as it occurred, and to tell its exact situation. His instructions had no pretensions to be grammatical;—his knowledge of the language, so far as it went, was gained entirely by reading, and by looking at it as a whole. He was of opinion, that a man did not deserve to learn what he had not principally worked out for himself; and that a teacher should be only a helper, to assist the pupil out of otherwise inexplicable difficulties. From these causes, his attempts to teach me Arabic, when he had already lost that facility in speaking it, without which it is impossible to dispense with grammatical instruction, to his disappointment and my shame, did not succeed. When I afterwards taught it myself, and sent him translations from it, he was greatly delighted.

"I have the most lively recollection of many descriptions of the structure of the universe, and accounts of Eastern countries, which he used to tell me, instead of fairy tales, when he took me on his knee before I went to bed. The history of Mohammed; of the first caliphs, particularly Omar and Ali, for whom he had the deepest veneration; of the conquests and spread of Islamism; of the virtues of the heroes of the new faith, and of the Turkish converts; were imprinted on my childish imagination in the liveliest colors. Historical works, on these same subjects, were nearly the first books that fell into my hands.

"I recollect, too, that on the Christmas-eve of my tenth year, by way of making the day one of peculiar solemnity and rejoicing to me, he went to a beautiful chest, containing his manuscripts,—which was regarded by us children, and indeed by the whole household, as a sort of Ark of the Covenant,—took out the papers relating to Africa, and read to me from them. He had taught me to draw maps, and, with his encouragement and as-

sistance, and I soon produced maps of Habbesh and Sudan.

"I could not make him a more welcome birthday present, than a sketch of the geography of Eastern countries, or translations from voyages and travels, executed as might be expected from a child. He had originally no stronger desire, than that I might be his successor, as a traveller in the East. But the influence of a very tender and anxious mother, upon my physical training and constitution, thwarted his plan, almost as soon as it was formed. In consequence of her opposition, my father afterwards gave up all thoughts of it.

"The distinguished kindness he had experienced from the English, and the services which he had been able to render to the East India Company, by throwing light on the navigation of the higher part of the Red Sea, led him to entertain the idea of sending me, as soon as I was old enough, to India. With this scheme, which, plausible as it was, he was afterwards as glad to see frustrated as I was myself, many things, in the education he gave me, were intimately connected. He taught me, by preference, out of English books, and put English works of all sorts into my hands; at a very early age, he gave me a regular supply of English newspapers;—circumstances which I record here, not on account of the powerful influence they have had on *my* maturer life, but as indications of *his* character.

"He entered, with the greatest indulgence and interest, into the half precocious, half infantine thoughts of the boy; built castles in the air with him; conversed with him upon all the topics of the day, and communicated to him his ideas and views, on all subjects that came under discourse. Thus, when we spoke of fortification, he brought out books and plans, and made me draw and measure polygons.

"In the winter of 1788, Herder sent him his Persepolis, the contents of which were extremely interesting to him. This gave him the greater pleasure, as it was the first proof he had received, for many years, that he was not forgotten by his countrymen—a pleasure mingled with

surprise. From that time, marks of the estimation in which he was held in Germany, as well as abroad, were continually becoming more frequent."

The war with Turkey, which broke out at this time, occupied his mind, intensely, and excited him to write several papers. The warmer was his attachment to the Arabs, and the more the peculiarity of his character led him to regard the Arabs of Medina, Bagdad, and Cordova, under the caliphs, as the people after his own heart, the more intensely did he hate the stately, unbending Turks—the tyrants and oppressors of his beloved Arabs—and he cordially wished that they might be driven out of that Happy Land, which under their government is becoming a desert.

The neighborhood of his native place, was one of the reasons which made it particularly agreeable to him to live in Ditmarschen. Of his relations, his half brother, Bartold Niebuhr, and his nephew, H. W. Schmeelke, were the nearest and dearest to him. The former, many years younger than himself, an opulent farmer, died unmarried long before him. He was a man of extraordinary capacity, and although he had gone but occasionally to school, and (as every thing was easy to him) applied but very little, he had acquired enough of the Latin language to understand the poets. "Uncle, what are you reading there?" said his nephew to him one day, seeing him with the Georgics in his hand. "I have hived some bees," answered he, in the dialect of his country, "and I want to see what Virgil writes about them."

When he saw Niebuhr in his uniform, as officer of engineers, he went up to him, looked earnestly at him, and said, smiling, "Brother, you look very well in that dress, but for all that you are a servant;—I am a free man." Schmeelke, for some time Bürgermeister (*i. e.* chief magistrate) at Otterndorf, was always Niebuhr's favorite, and before his travels into Arabia he had bequeathed to him the greater part of his property, as his brother did not want it. The uncle and nephew frequently exchanged visits, and Niebuhr was never so happy as in Hadeln. He had no relation, however distant, no connexion of

the friends of his early youth, whose circumstances he did not know, in their most minute details, and treasure up in his memory.

"The appearance of the long-expected travels of Bruce," says Mr. Niebuhr, "formed an epoch in our uniform life. My father had never been one of those who carried skepticism so far, as to question whether Bruce had ever been in Abyssinia, at all. He read his work, without prejudice, and the conclusion he arrived at, was the same, which is, since the second Edinburgh edition, and the publication of Salt's two journeys, the universal and ultimate one. In a paper, which he sent to the new 'Deutsches Museum,' he showed, that Bruce had exactly copied the pretended determination of the elevation of the Pole, on the Arabian Gulf, from himself; —that the conversation with Ali Bey was a palpable fabrication and romance;—that the pretended journey over the Red Sea, in the country of Bab el Mandeb, as well as that on the coast south from Kossir, were also mere fiction. On the other hand, he declared, that, mixed up with these gross falsehoods, there were parts of the travels which bore an impress of perfect truth, and might be confidently believed. About the same time, he was incited, half in indignation, half in wantonness, to give his opinion on a fantastic dream, concerning the origin of the Pyramids and of Persepolis, put forth by Witt, who maintained that they had been wholly misunderstood, and were works of Nature."

At the beginning of the year 1790, he had the great pleasure of receiving a letter from his old friend Dr. Russel, begging of him his ground-plan of the city of Aleppo, for the new edition he was about to publish of his description of that city. It is hardly necessary to say, that Niebuhr did not refuse it. Dr. Russel greatly improved upon it, by the addition of the most remarkable buildings, by more correct drawings of the principal streets, and omission of the remainder. Niebuhr's plans, with the exception of Kahira, which is as perfect as that of any city in Europe, are, as he himself has observed, to be considered complete, only as far as the circum-

ference, the gates, and the principal buildings are concerned.

Out of this renewed correspondence with Dr. Russel, arose one with Major Rennel, who wished to avail himself of Niebuhr's unpublished map, of his route through Syria and Natolia, with a view to a general map of Asia he had it in contemplation to publish. Niebuhr was too generous and too free from all petty jealousy to hesitate a moment in complying with this request. About the same time, Marsden showed his respect for him by sending him his History of Sumatra.

After the correspondence with Rennel had lasted some time, Niebuhr sent him a few of his lunar calculations, the verification of which he had so extraordinarily at heart, and entreated him to induce Maskelyne to undertake this task: this, however, was not attended with any success.

"I must here," adds his son, "depart from chronological order to speak of his correspondence with two excellent men of letters, which, however, if I mistake not, took place some years later. Silvestre de Sacy, while deciphering the Pehlwi inscriptions at Nakschi Rustam, had discovered the incomparable accuracy of my father's drawings; and he, who always entertained the highest reverence for the author of that masterly philological work, felt grateful to De Sacy for calling into life, labors, which were dead, so long as the key to them was wanting. A very agreeable correspondence soon arose between two men of science, bound to each other by such ties. Silvestre de Sacy was at that time employed upon the compiled translation of the Bark el Jemen, *i. e.* the History of the Conquest of Yemen by the Turks. In the prosecution of this work, he had used my father's geography in his Description of Arabia, and his map of the empire of the Imaums, and had found the astonishing result that every place mentioned in the history, excepting only two villages in Tehama, were laid down with perfect accuracy. So far as the map was determined by his actual progress through the country, this is less surprising; the remarkable, and the far greater part, is that

which rests on the connexion between such data concerning distance and direction as he could collect. Here, nothing, but the most acute judgement and accurate induction, could have enabled him to decide on the internal evidence of varying testimonies, and to give to each its due value.

"Out of this correspondence, afterwards arose another, which was also extremely valuable to him—that with the learned, industrious, and clear-sighted geographer, Barbier du Bocage. He applied to my father, for materials for the construction of his map of Natolia, and received both astronomical determinations of places, and itineraries which my father had written down from the oral testimony of the camel-drivers of the caravans."

In November, 1792, Niebuhr was attacked by a pleurisy, of which he very nearly died, and recovered very slowly. Fulness of blood, occasioned by the quiet and inactive life he had led for so many years, was the cause of very severe illness and of long derangement of health. The following year, he spit blood. He was not absolutely ill, but his spirits were extremely languid and depressed: he complained of oppression on the chest, and indisposition to move. He had another complaint, which made him very anxious. For several years a sort of wart or wen had been growing under his right eye, and every means resorted to had only inflamed and increased it. The surgeon whom he consulted thought it alarming; the more so because he dared not venture on an extirpation. After enduring pain and anxiety for some years, it was at length cured, and at the close of his sixty-sixth year he was happily restored to perfect health. An accident led him to purchase some moorland, a league from his house, and to undertake the cultivation of it. It revived all his taste for the employment of his early life; he laid various schemes of agricultural improvement, pursued them with youthful ardor, and promised himself the most favorable results: he planted trees, cut drains, and bought land, till he had altogether a very considerable estate. The consequences were not answerable to his hopes; a great deal of money was lost—if, indeed, that can be called

lost, which not only left the land improved and productive, but lengthened and enlivened his remaining days.

He took much and strong exercise, went to his farm on foot or on horseback, returning with unwearied activity to every spot where any thing remained to do. As the fields, in that part of the country, are divided by very broad ditches, he made use of a leaping pole, to which he had been accustomed in his youth. He had grown so young and so robust, that he jumped over a ditch, ten feet wide, in his seventieth year. His farm made many things interesting to him which had formerly been indifferent, and his peculiar talent for observation and investigation, found animating employment and food. He studied, in the greatest detail, the sort of agriculture suited to the marsh and heath lands of his own district, and the neighboring ones on the same side of the river, and all the long-forgotten knowledge of the subject, which he had acquired in his youth from personal observation, revived in his mind. "I still hope," says his son, "to obtain possession of a series of letters from him, written in the year 1801, in which, after the most careful inquiries, he replied to a list of queries I addressed to him, on the different kinds of marsh-land, the under strata, the proportion between the seed and the produce of various sorts of grain, and the fundamental rules of the old valuation of the land, with a precision and copiousness to be expected only in replies to the interrogatories of a committee of the British House of Commons.

"Still later, in 1809, in the seventy-seventh year of his age, he surprised me by a collection of notes, in answer to the inquiry, whether, before the existence of the marshes along the whole coast of Friesland, from Jutland to the Vlie, there had been moors extending behind the *Dunes* or Denes, which are now washed away; as also, in answer to the question, whether the mean height of the tide were always the same, and had not, for a long series of years, been continually gaining, or were subject to long periods of gaining and losing. These queries were contained in a letter, addressed to him from Holland. The facts, which he brought together, in reply, gave evidence

of all his peculiar acuteness and accuracy of observation.

"These occupations diverted him from dwelling on a misfortune, which had been a source of great vexation to him, for some years before he devoted himself to them. The copper-plates, belonging to the works which had appeared, as well as those executed for the yet unpublished volume, were deposited at Copenhagen, in the house of a friend, which was reduced to ashes, in the great fire of June, 1795. All these plates were destroyed; and with them, perished all desire, all heart, for the completion of the unfinished volume.

"An opportunity did, indeed, shortly present itself, for the publication of its contents, though not in Germany. In England, his reputation was so high, that almost every body, who heard my name, accosted me with cordial inquiries for my father, and an acquaintance with his works was so widely diffused through the medium of Heron's extracts, that I met with them in the houses of several country people, and a friend of mine found them, even in the island of Mull. Very eager inquiries were now addressed to him, from that country, whether he would not publish the deficient volume there, and in the English language. This he declined, partly because he anticipated more difficulties from the sending over a copy of the manuscript for me to translate, than really existed; but partly, also, because, with all his attachment to England, he thought it unbecoming and wrong to suffer the conclusion of a work, which might be considered as the property of the Danish government, to whom it owed its very existence, to appear in any other country than Denmark, or in any other language than German. At subsequent periods, the same proposal was renewed to me, first in 1802; and when I saw that all hope of his giving a German edition was at an end, and at the same time that he was fully satisfied of the correctness of his geographical and astronomical observations, I earnestly entreated him to send me the MS., and to permit it to be translated. My intention was to append to it a translation of the history of Zebid, which he sent to Copenhagen,

together with other MSS., and which is still to be found in the royal library there. It contains a circumstantial history of Yemen, from the time of its separation from the caliphate through the whole of the middle ages. I also intended to extract all that was not botanical, from Forskaal's cruelly neglected works, and to annex these, together with a general map of Arabia. My father persisted in his refusal, of which he, however, afterwards repented. During the campaign in East Prussia, Lord Hutchinson, one of his most zealous admirers, made the same proposal to him, through me, and offered to negotiate the affair on the most advantageous terms, according to the relations generally subsisting in England between author and publisher. But at that time, I had no longer the power of making any historical additions to the description of Arabia; the sending the manuscripts to me, even after the peace of Tilsit, was very doubtful; and the conveying the translation to England, during the tyrannical prohibition of all intercourse, attended with great danger."

In Zach's Monthly Correspondence, Niebuhr found some remarks and criticisms on Mayer's system of longitudinal observations, which he little expected, having scarcely any means of observing the developement and growth of science in the remote corner of the world where he lived. Agreeably surprised, he immediately communicated to M. Von Zach the existence of his own observations, the earliest which had been attempted upon the system in question, and offered to send them to him. The readers of Zach's journal, know how this offer was received, by M. Von Zach and M. Von Bürg, and what judgement they pronounced on his determination of places, after they had been calculated according to Bürg's perfected tables: this treasure of the geography of Asia, is now on record, in the above-mentioned correspondence.

The tranquillizing assurance, that he had not labored in vain, and that he was at length understood and appreciated, was a balm and a cordial to his old age. In 1802, he was further gratified, by the distinction conferred upon

him, in being appointed foreign member of the Institute of France; for, although his native dislike to that country had been increased by the tyrannical domination which now pressed so heavily on the continent, he nevertheless acknowledged, that, in the sciences to which he had devoted himself, no Society could then, for dignity and splendor, be compared with the National Institute.

Another agreeable incident, which marked this period, was, that an addition to his salary, proportioned to the general rise in prices, since his residence in Holstein, was made, by the voluntary favor of the present King of Denmark, then Crown Prince. From the time this prince took the reins of government, Niebuhr received marks of distinguished favor from him, without any request or application on his part. Although, perhaps, he owed this principally to his fame, as a traveller and a man of science, he had deserved it no less as a public functionary. The business of his office, which consisted chiefly in the collection of taxes, and in public accounts, was not indeed very agreeable to him, nor suited to a man of his turn; he however executed it with unwearied diligence and fidelity. The mildness and consideration with which he performed his duty, often at the risk, or with the certainty, of personal loss, at a time when the growing burden of the taxes was so great, as to convert the industrious peasant into a dilatory payer, won him the gratitude of the people; while the exactness and extraordinary intelligence he displayed in the discharge of his duties, insured him the respect and applause of the government. Among the concerns committed to his care, was one which was peculiarly attractive to him, and which opened a wide field for improvement. This was the superintendence of the out-dikes. He reflected much, on the means of promoting and accelerating their increase, especially by draining the *priele* and *sprante*, (as the natives call the small channels which, at ebb-tide, are left flowing through the bed of the river,) and was unremittingly engaged in drawing up notices and reports with the hope of obtaining approbation and money for the prosecution of the work, the cost of which could be but slowly

replaced. In his frequent visits to these lands, he was led particularly to observe the very remarkable phenomena exhibited by the successive layers, so to speak, of vegetation, growing one out of another, on the gradually increasing additions to the soil; from the plants, of the *salsolæ* tribe, which grow in the mud, deposited by the ebb-tide, to the fine grasses of the mature crust or soil. These had been hitherto unobserved; and, if they are now known to naturalists, it is probably through his repeated descriptions, of appearances, which had been noticed, only, by the shepherds and husbandmen of these extensive pastures.

From the earliest time of his appointment to his office up to the year 1802, the duties he had to discharge, were nearly unaltered; from that time, they increased, in proportion as the necessitous state of the public finances, gave occasion to an increase of the public burdens. The first, of the many fresh taxes which succeeded, were the land and usufruct taxes, in the imposition of which, the old registers of the country were entirely disregarded, and a new valuation became necessary. In the commission appointed for the district, Niebuhr, from his official knowledge and connexions, and from his personal zeal, was the most active, indeed almost the only working member. In order to appreciate what a task this was, we must first conceive a district, containing twenty-four thousand inhabitants, all agricultural; the whole land divided into small ownerships, which were smaller, in proportion as the marsh was more fertile. Niebuhr revised the valuation himself, and deliberated and decided on the appeals. In his seventy-first and seventy-second years, he worked through a great part of the night, nor did his indefatigable zeal relax, even when his sight began to fail. The reader will remember how his eyes suffered, from drawing, at Persepolis. They afterwards sustained a sudden, and still more fatal, shock, from his negligence, in not using colored glass, during a solar observation. Egypt and the deserts, had also left permanent effects upon them. The consequences of this night-work were irremediable and fatal. In a short time, he could no longer see to read; and for

writing, he required an extraordinary quantity of light, and even then, the lines were often run into one another. This blindness, the progress of which, he clearly perceived, was not to be arrested, made him very anxious, the more, as it threatened to compel him to resign his employment. This he was happily enabled to avoid.

His wife, after many years' suffering from asthma, which ended in water in the chest, died, in December, 1807. His daughter and the widowed sister of his wife, who had lived with her for twelve years, freed from the constant care her illness had demanded, could now devote themselves wholly to rendering him the assistance of which he stood so much in need. His daughter did not confine herself to administering to his bodily wants and infirmities, she did that part of his business, which he was no longer able to do. This, however, was not sufficient, as his sight became worse and worse, and what he wrote, with the utmost care, was nearly illegible.

His family and friends regarded it as one of the best rewards of his honorable and useful life, that, at the close of it, he found a friend, who undertook the discharge of the duties of his office, with all the devotion and attachment of a son. Gloyer, who became his successor, took a deep and lively interest in statistics, to which we owe his valuable and instructive fragments on India, and on the state of taxation in that country. He was introduced to Niebuhr, who found his society so delightful, that, as he was not engaged in any employment, he invited him into his house as an assistant. Gloyer complied with his wishes, and the government acceded to Niebuhr's request, that his friend should be officially recognised in that capacity. Gloyer shared the labors of the office; and the tranquillity with which Niebuhr could confide the execution and credit of his post to such a friend, and such a daughter, were the best rewards for the fidelity with which he had discharged its duties. He felt it to be so. He did not, however, withdraw his mind from his business; he had kept the thread of it, unbroken, though he had so long been blind; every thing was read aloud to him, and discussed with him. Gloyer's conversation and daily in-

tercourse, revived to his mind's eye many a faded or vanished picture of the East, and the books which this invaluable friend read aloud to him, and the circumstances he related, put him in possession of the works and statements of more recent travellers. This was without comparison the highest enjoyment of which he was susceptible.

"When I related to him," says his son, "the descriptions of any traveller newly returned from the East, or gave him, in my letters, any accounts of travels not known on the continent, his whole being seemed reanimated, and he dictated answers which showed that his mental vision was vivid and powerful as ever. It was still more remarkable, that these new facts imprinted themselves on his mind with all the depth and sharpness with which objects are stamped on a youthful memory, and so remained up to the time of his death. He combined them with what he had himself observed and experienced."

"Among the circumstances, which contributed to gladden his old age, was the constant intercourse he enjoyed, with a family brought up in Meldorf, and nearly related to him, the members of which, were like children and grandchildren to him. His friendship with the Treasurer of the district, Piehl, who, in the management of the concerns of the province, exhibited the rarest combination of sagacity and aptitude, and whose whole character was the perfect model of the citizen of a republic, became more close and intimate in proportion as both advanced in age. A visit from this excellent friend, when he returned from one of his journeys into the country, or a visit to his house, where every thing bespoke his active mind and beneficent disposition, were festivals. Piehl was indeed a most remarkable man; a history of his life and of his administration of the finances of the province, into the frightful chaos of which he introduced order; actively and prudently, so far as was possible to human efforts, taking advantage of good times, and correcting the remaining influence of bad ones; lightening the terrible pressure on the people by the sacrifice of his own property, and the offer of his own credit;—a history of

this noble example of public service, for the display of which, a free agricultural community, managing its own affairs, affords the sole field, would be a well-deserved monument to his honor; an edifying and instructive document, to all placed in the same circumstances, and to all who entertain sincere and conscientious doubts, as to the blessings of a free and democratic government.

"These various mental pleasures and consolations, became so much the more necessary, from his increasing bodily infirmities. He was of a phlegmatic, robust, and plethoric constitution, to which, from the habit of many years, bleeding had become indispensable. Unfortunately, he conceived the idea, that his great age rendered it necessary to discontinue this; nor could any warnings or remonstrances induce him to resort to it again, till, at length, attacks of dizziness, sudden deafness, and spitting of blood, showed the danger to be imminent. These symptoms, which began about the time of his wife's death, continued to return, with more or less violence, every spring and autumn; till, in October, 1813, he was attacked by a frightful bleeding at the nose, which, however, his robust temperament enabled him to rise above.

"Sated, though not disgusted, with life, he frequently, in the course of this year, expressed his willingness to rejoin his wife, whenever God's good time were; yet he wished to live to see the destinies of the world decided, and once again to embrace his absent children. His wishes were granted, though he was first compelled to behold an invading army in Holstein. The distress and terror which such an event always brings in its train, did not overcome his joy at the deliverance of Europe, and the glorious triumphs of Germany and her allies."

"One of the symptoms of increasing infirmity, and a consequence of the sort of attacks already mentioned, was a weakness in one leg, which occasioned him many falls. It was, however, unattended with any important consequences, till an unlucky fall, in March, 1814, which injured his right thigh, and caused a permanent lameness in it. From that time, he was never able to set his foot to the ground; nor could he move, without assistance, or

without pain; he could only be removed from his bed, in the afternoon, on a wheeled chair. He clung long to the hope of recovery; but even the gradual decline and extinction of this hope, could not abate his truly saint-like gentleness and resignation. Gratitude to Gloyer, who helped to carry and move him about, and whose solicitude to occupy and amuse him was unwearied and inventive; to his daughter, who devoted herself entirely to him; to his sister-in-law, and to all who showed him any kindness, rendered him happy even amid pain and infirmity.

"It was thus we found him," says his son, "in the autumn of 1814; and his appearance was calculated to leave a delightful picture in the mind. All his features, as well as his extinguished eyes, wore the expression of the extreme and exhausted old age of an extraordinarily robust nature;—it was impossible to behold a more venerable sight. So venerable was it, that a Cossack who entered, an unbidden guest, into the chamber where he sat with his silver locks uncovered, was so struck with it, that he manifested the greatest reverence for him, and a sincere and cordial interest for the whole household. His sweetness of temper was unalterable, though he often expressed his desire to go to his final home, since all which he had desired to live for, had been accomplished.

"A numerous, and as yet unbroken, family circle, was assembled around him; and every day, in which he was not assailed by some peculiar indisposition, he conversed with cheerfulness and cordial enjoyment on the happy change which had taken place in public affairs. We found it very delightful to engage him in continued recitals of his travels, which he now related with peculiar fulness and vivacity. In this manner, he once spoke much, and in great detail, of Persepolis, and described the walls on which he had found the inscriptions and bas-reliefs, exactly as one would describe those of a building visited within a few days, and familiarly known. We could not conceal our astonishment. He replied, that as he lay in bed, all visible objects shut out, the pictures of what he had beheld in the East continually floated before his mind's eye, so that it was no wonder he could speak

of them, as if he had seen them yesterday. With like vividness, was the deep intense sky of Asia, with its brilliant and twinkling host of stars, which he had so often gazed at by night, or its lofty vault of blue, by day, reflected, in the hours of stillness and darkness, on his inmost soul;—and this was his greatest enjoyment. In the beginning of winter, he had another bleeding at the nose, so violent, that the by-standers expected his death; but this, also, he withstood.

"About the end of April, 1815, the long-existing obstruction in his chest grew much worse; but his friendly physician alleviated the symptoms, which, to those around him, appeared rather painful than dangerous. Towards evening, on the 26th of April, 1815, he was read to, as usual, and asked questions, which showed perfect apprehension and intelligence: he then sunk into a slumber, and departed without a struggle."

A concourse of people, from all parts of the country, attended his body to the grave. It was the opinion of all, that no individual had ever been so universally regretted. The funeral was solemnized with all the honors which respect and affection can pay. He had attained the age of eighty-two.

He was counsellor of state of Denmark; knight of the Dannebrog, of the fourth class; secretary to the district of South Ditmarschen; member of the Society of Sciences of Göttingen; of the Swedish and Norwegian Societies; and of the Society for the Investigation of Natural Science; and Foreign Member of the National Institute of France.

In stature, he was rather under the middle size, of a very robust and sturdy make; up to his fortieth year, thin, but later in life, thick set and fat. There is only one engraving of him extant,—a bad copy of a good picture painted in his youth. It is prefixed to a volume of the '*Allgemeinen Deutschen Bibliothek.*' His person and carriage, the sturdy-looking head, the powerful neck, and his whole gesture, gave him a completely Oriental air. When seen, from behind, in an eastern dress, especially when walking and in conversation, gesticulating with his

hands, no man could have distinguished him, among a party of Arabs. I have often been struck with this, when I have looked after Moors of the Barbary states, in the streets.

He was extremely frugal: economy had become a habit with him in early life. As a peasant lad, he drank nothing but water and milk; and at a later period, he deviated from this simple diet, only in compliance with the customs of others, with which he every where made it a rule to conform, and he then drank an extremely small quantity of wine. He had no favorite dishes, but the peasant fare of his native land.

He was, and remained through his whole life, *a true and genuine peasant*; with all the virtues, and with the little failings, of the class from which he sprang. He was, unquestionably, somewhat obstinate; and it was very difficult to reason him out of an idea he had once strongly taken up; he continually reverted to it. Equally strong and inveterate were his prejudices, for, and against, men. This pertinacity, however, it was, which gave him strength, during the greater part of his life, to follow the path he had chosen, through every difficulty and danger. His moral character was spotless, and his manners were extremely pure and severe. In every circumstance and relation of life, he was unpresuming and disinterested.

The bent of his mind, was entirely for the observation and investigation of sensible objects: abstraction and speculation were foreign to his genius, which could lay hold of nothing but the concrete. With regard to books, he was most rigorous as to the truth of the statements they contained; that form of conveying them, pleased him the best, which was the simplest. Poetry, except Homer, in Voss's translation, Göthe's Hermann and Dorothea, and songs for music, was quite uncongenial with his tastes. Fielding and Smollett's novels he loved; he had read no others. Architecture interested him; but to the arts of painting and sculpture he was indifferent; music he loved.

He lived in observation and perception. A friend of his own age, who took a short journey with him when

both were advanced in life, silently remarked, and afterwards related, with great delight, how he had found something to observe and to investigate, in every field and every village they passed through. In his sixty-eighth year, he visited this same friend, in his then residence, where he had never before been. The morning after his arrival, he let himself out at the house-door, at four o'clock in the morning, and, before breakfast, had wandered through and around the whole town, and had so perfect and exact a picture of it, in his mind, that every house and every building he inquired about, was instantly recognised and named from his description.

This exclusive turn of his mind rendered him indifferent to subjects of mere speculation. He advanced towards the unknown regions, with the full tranquillity of a conscience "void of all offence" and of all blemish. He relied, for the protection of himself and those dear to him, on that overruling Providence, of which, in the course of his own life, he had had striking experience. "It is extraordinary," says his son, "that this man, so remarkably devoid of imagination, so exempt from illusion, waked us on the night in which his brother died, though he was at such a distance that he knew not even of his illness, and told us that his brother was dead. What had appeared to him, waking or dreaming, he never told us."

As he had conceived a very high and extensive idea of the duties which devolved upon him on his travels, he never lost the remembrance of the designs he had relinquished, in compliance with the wishes of others, or in consequence of obstacles. He reproached himself for these omissions, with a severity which we never could convince him was exaggerated and unjust. In his old age, these self-tormentings assumed a character which gave us great pain. Acknowledgements of his merits by competent and experienced judges, such as Reiske, Silvestre de Sacy, Rennel, &c., gave him the sincerest pleasure: to external honors or homage addressed to his vanity, he was quite inaccessible. Nobility, which was offered him by the minister Guldberg, he refused. The title which he was compelled by custom to assume, as officer of

engineers in the Danish army, led a relation of his to ask him, "If he had caused himself to be ennobled?" "No," replied he, "I would not offer my family such an affront."

He founded, and bequeathed to his family, a more enduring nobility. To this time, no traveller returns from the East, without wonder and gratitude towards such an instructer and guide, the first and best of all describers of the East. Not one, of all who have hitherto followed, has equalled him; and it is yet doubtful, whether he will ever find a successor, who will complete what he has left unfinished of the description of Arabia, and worthily occupy a place by his side.

If our object were to enumerate the important accessions which have been made, both to geography and the other sciences, by persons who have devoted their lives to travelling, there are many other eminent names which should not be here omitted. But we can attempt now only to sketch very briefly the career of one, who, although he perished in that enterprise, fatal to so many of his forerunners, the attempt to penetrate into central Africa, is and will continue to be chiefly remembered for his researches and discoveries in another quarter of that great continent; we mean the late lamented Belzoni. Giovanni Battista Belzoni was born in 1778, at Padua, where his father was a barber. The family, however, had belonged originally to Rome; and it is related that Belzoni, when only thirteen years of age, betrayed his disposition for travelling, by setting out one day, along with his younger brother, to make his way to that city, which he had long been haunted by a passionate desire to see, from hearing his parents so often speak of it. The failing strength and courage of his brother, however, forced him to relinquish this expedition, after they had proceeded as far as the Apennines; and he returned once more to assist his father, in his shop, as he had already for some time been doing. But when he was three years older, nothing would detain him any longer in his native place; and he again took the road to Rome, which, this time, he actually reached. It is said, that on his first

arrival in this capital, he applied himself to the acquirement of a knowledge of the art of constructing machines for the conveyance and raising of water, with the view, probably, of obtaining a livelihood by the exhibition of curious or amusing experiments in that department of physics. It is certain, however, that he eventually adopted the profession of a monk, as offering an easier or surer way of gaining his bread.

The arrival of Bonaparte in Italy, in 1800, brought him the opportunity, which he embraced, of throwing off his monastic habit, being, by this time, heartily tired of the idleness and obscurity to which it consigned him. He then pursued, for some time, a wandering life, having in the first instance returned to his native town, and then proceeded in quest of employment to Holland, whence, in about a year afterwards, he came back to Italy. By this time, he had attained so uncommon a height, with strength proportioned to it, that he was an object of wonder, wherever he was seen. It was probably with the expectation of being able to turn these personal advantages to account, that he determined, in 1803, to pass over to England. On arriving there, accordingly, he first attempted to get a maintenance by perambulating the country, exhibiting hydraulic experiments and feats of muscular strength; and, accompanied by his wife, an Englishwoman, whom he had married soon after his arrival, he visited, with this object, all the principal towns, both of Great Britain and Ireland. He was afterwards engaged, for some time, at Astley's amphitheatre; and altogether he continued for about nine years in England.

At last, finding, probably, that he had no further chance of improving his circumstances in that country, in 1812, he sailed with his wife for Lisbon. Here he soon obtained an engagement, from the director of the San Carlos theatre; at the expiration of which, he proceeded to Madrid, where, for a time, he also attracted considerable attention by his performances. From Madrid he went to Malta; and here, it is supposed, the idea first suggested itself to him, of passing over to Egypt,

as others of his countrymen had already done, and offering his services to the Pacha, the active and enterprising Mohammed Ali. Accordingly, carrying with him a recommendation from a Maltese agent of the Pacha's, he proceeded, still accompanied by his wife, to Cairo. On presenting himself to Ali, he was immediately engaged, on the strength of his professed skill in hydraulics, to construct a machine for watering some pleasure gardens, at Soubra, on the Nile. This undertaking, it is said, he accomplished to the Pacha's satisfaction; but an accident having occurred, to one of the persons looking on, on the first trial of the machine, the Turkish superstition, under the notion that what had happened was a bad omen, would not suffer the use of it to be continued. This misfortune, at the same time, put an end to all Belzoni's hopes of further employment from the Pacha; and he was once more, probably, as much at a loss what to betake himself to, as he had ever before been, in his life.

The state of destitution, however, in which he found himself, led to his entering upon a new career, in which he was destined to acquire great distinction. The late Mr. Salt was at this time the English Consul, in Egypt, and, embracing the opportunity which his situation afforded him, was actively employed in investigating and making collections of the precious remains of antiquity, in which that country abounded. For this purpose, he kept several agents in his pay, whose employment it was to make researches, in all directions, after interesting objects of this description. To Mr. Salt, Belzoni now offered his services in this capacity; and he was immediately employed by that gentleman in an affair of considerable difficulty, namely, the removing and transporting to Alexandria, of the colossal granite bust of Memnon, which lay buried in the sands, near Thebes. The manner in which Belzoni accomplished this, his first enterprise in his new line of pursuit, at once established his character for energy and intelligence. Dressing himself as a Turk, he proceeded to the spot, and there, half persuaded and half terrified the peasantry into giving him the requisite assis-

tance in excavating and embarking the statue, till he had the satisfaction, at last, of seeing it stowed into the boat intended for its conveyance, without having received any injury, and fairly afloat on the Nile. Having arrived at Alexandria, it was afterwards sent to England, and is now in the British Museum.

Belzoni had now found his proper sphere, and henceforth, his whole soul was engaged in the work of exploring the wonderful country in which he was, in search of the monuments of its ancient arts and greatness. In this occupation, he was constantly employed, sometimes in the service of Mr. Salt, and sometimes on his own account. The next affair which Mr. Salt committed to him, was the excavation of the Temple of Ipsamboul, in Upper Egypt, which was so enveloped in sand, that only its summit was visible. Belzoni, however, in despite of innumerable obstacles, partly of a physical nature, and partly created by the opposition of the natives, at last succeeded in penetrating into its interior. On returning from this expedition, he next undertook a journey to the valley of Beban el Malouk, beyond Thebes, where, from a slight inspection, on a former occasion, of the rocky sides of the hills, he had been led to suspect that many tombs of the old inhabitants would be found concealed within them. For some time he searched in vain, in all directions, for any indication of what he had expected to find, till at last his attention was suddenly attracted by a small fissure in the rock, which presented to his experienced eye something like the traces of human labor. He put forward his hand to examine it, when the stones, on his touching them, came tumbling down, and discovered to him the entrance to a long passage, having its sides ornamented with sculpture and paintings. He at once entered the cavern, proceeded forward, and, after overleaping several obstacles, which opposed his progress, found himself in a sepulchral chamber, in the centre of which, stood an alabaster sarcophagus, covered with sculptures. He afterwards removed this sarcophagus, and with infinite labor took exact copies of the drawings, consisting of nearly a thousand figures, and the hie-

roglyphic inscriptions, amounting to more than five hundred, which he found on the walls of the tomb. It was from these copies, that Belzoni formed the representation or model of this tomb, which he afterwards exhibited, in London and Paris.

On returning to Cairo, from this great discovery, he immediately engaged in a new investigation, which conducted him to another, perhaps still more interesting. He determined to make an attempt to penetrate into one of the pyramids; and was at last fortunate enough to discover, in that called the pyramid of Cephrenes, the entrance to a passage, which led him into the centre of the structure. Here he found a sepulchral chamber, with a sarcophagus in the middle of it, containing the bones of a bull,—a discovery which has been considered as proving that these immense edifices were in reality erected by the superstition of the old Egyptians, for no other purpose than to serve each as a sepulchre for one of their brute divinities. After this, encouraged by the splendid success that had hitherto attended his efforts, which had now made him famous over Europe, Belzoni engaged in various other enterprises, of a similar character, which we have not room to enumerate. He made also several journeys, both to the remote parts of Egypt, and beyond the bounds of that country, into the adjoining regions of Africa. At last, he determined to revisit Europe, and accordingly he set sail for that purpose, in September, 1819.

The first place which he visited, was his native city, from which he had now been absent nearly twenty years. When he left it, last, he was an unknown wanderer, without employment or the means of existence, and ready almost to accept the humblest that might be any where offered him; he returned to it, now, with a name familiar over the civilized world, and the glory of many discoveries, which had long made him the pride of his fellow-citizens. He presented, on this occasion, to the town of Padua, two lion-headed granite statues, which were placed, by the magistracy, in a conspicuous situation, in the Palace of Justice; and a medal was at the same time

struck, in honor of the giver, on which were inscribed his name, and a recital of his exploits. A copy of this medal, in gold, was presented to Belzoni, accompanied with a letter, expressive of the admiration felt by the Paduans, for their distinguished townsman. From Italy, Belzoni hastened to England, where the rumor of his discoveries had already excited a greater interest, than in any other country. Here, he met with the welcome, due to one whose services had contributed to extend the scientific glory of the nation; and, both in the world of letters, and in the world of fashion, the celebrated traveller became a chief object of attraction. He now employed himself, in preparing an account of his travels and discoveries for the press; and the work appeared about the end of the year 1820, in a quarto volume, accompanied with another volume, of plates, in folio. It excited great interest, and soon passed through three editions; while translations of it, into French and Italian, had also appeared at Paris and Milan. It was after the publication of his book, that Belzoni prepared his representation of the tomb he had discovered at Beban el Malouk, which was exhibited in London and Paris.

Tired, however, of leading an inactive life, Belzoni soon began to project other schemes of foreign travel. He visited, successively, France, Russia, Sweden, and Denmark; after which, returning to England, he undertook, under the auspices of the government, to prosecute the perilous attempt of penetrating into central Africa. His plan was, to endeavor, in the first instance, to reach Timbuctoo, thence to direct his course eastward, towards Sennaar, and then to return through Nubia and Egypt. But even his experience, skill, and extraordinary personal strength and prowess, did not save him from falling a victim in the cause in which so many gallant men had already perished. He left England, towards the end of the year 1822, for Gibraltar, on reaching which, he immediately embarked for Tangiers. From this, he proceeded to Fez, where he was well received by the Emperor of Morocco, and obtained permission to join a caravan for Timbuctoo, which was to set out in a few

days. Unexpected difficulties, however, arose when he was on the point of departure; and after a residence at Fez of five months, he was obliged to give up all hope of commencing his journey by the route he had originally fixed upon. On this disappointment, he sailed for Madeira, and thence, in October, 1823, he set out for the mouth of the river Benin, on the west coast of Africa, with the intention of making his way to the interior from that point. He entered upon this journey, accompanied by an English merchant, who was to conduct him as far as the town of Benin, and to introduce him there to the king of the country; but by the time he had arrived at this place, a malady, which had attacked him almost as soon as he had set his foot on shore, had reached such a height, that he was unable to proceed any further; and he begged his companion to have him taken back to Gato. He arrived there on the 2d of December, in a dreadfully exhausted state, and being immediately attacked with delirium, expired on the following day. His remains were interred under a plane-tree on the shore, while the English vessels on the station honored his memory, by discharges of their cannon, during the ceremonial. An inscription, in English, was afterwards placed over his grave, recording his melancholy fate, and expressing a hope, that every European who might visit the spot, would, if necessary, cause the ground to be cleared, and the fence repaired, around the resting-place of the intrepid and enterprising traveller.

Many other names, of persons of both sexes, yet remain on the records of literature, science, art, and the other departments of intellectual exertion, which might be referred to, as illustrating the Pursuit of Knowledge under Difficulties. But the selection of examples we have made, regulated as it has been with a view to give as much diversity of interest as possible to the contents of

the work, will probably be thought sufficiently extensive for our purpose. The lesson we would teach, as we have already frequently had occasion to remark, is, that in no situation of life, be it what it may, is the work of mental cultivation impossible, to him, who, in good earnest, sets about it. What is chiefly wanted, to invigorate the mind to the encounter and conquest of the most formidable difficulties, which any circumstances can oppose to it, is simply the conviction of this truth; and of that conviction we can bring forward nothing likely to produce a more deep and abiding impression, than some of the histories recorded in the preceding pages.

[As the English edition of these two volumes was occupied with examples drawn from other countries than our own, to the exclusion of the numerous examples of a similar character which the United States would have afforded, with the exception only of notices of Franklin, West, and Ledyard, we have omitted the sketches of these three individuals, and supplied the place with other interesting matter, intending to have the subject continued in a succeeding volume, which will be devoted to examples selected from among our own countrymen.—Am. Pub.]

A GLOSSARY.

OF THE LATIN, FRENCH, AND OTHER NOT-EASILY-UNDERSTOOD WORDS AND PHRASES.

ALSO, A BRIEF DESCRIPTION OF THOSE PERSONS AND PLACES SPOKEN OF, WHOSE HISTORY CONTAINS SOMETHING PECULIAR, OR A KNOWLEDGE OF WHOM CANNOT BE OBTAINED FROM SOURCES ORDINARILY WITHIN THE REACH OF THE READER.

Abyssinia, an extensive kingdom, in the Eastern part of Africa, bordering on the western coast of the Red Sea, and south of Nubia, anciently called Upper Ethiopia. It is traversed by three ranges of mountains, the eastern range being near the Red Sea, and rendering the country nearly inaccessible from the coast. One of the branches of the River Nile rises in this country. The Christian religion formerly flourished here; but it has long been in a declining state.

Academy, a place of education; a school of philosophy; an assembly or society of learned men, uniting for the purpose of conferring together upon discoveries already made in the sciences, or to try experiments for their further improvement. The name is derived from the groves of Academus, in the vicinity of Athens, about one eighth of a mile from the city, where the Philosopher Plato resided, and gave his instructions; from which time, they became, in a great measure, sacred to philosophy. In this Volume, the name is confined to the various public societies, established in different countries, for the improvement of the arts and sciences. The Academy of St. Petersburg, the Royal Academy, at London, the Academy of Sciences, at Paris, and the Venetian Academy, are those referred to in this Volume. There is, in this Country, an American Academy of Arts and Sciences.

Achromatic, colorless.

Acids, a class of chemical substances, which are so called from their taste. They change vegetable blue colors to red. When they combine with alkalies, or the metallic oxides and earths, they form the compounds called salts. *Mineral acids* are those which are produced from a union of oxygen gas with mineral substances, as sulphur. Most of the acids contain oxygen.

Adelphi, an assemblage of buildings in London, erected in 1770, by four brothers, of the name of Adam, all of whom were architects. The buildings are situated south of the Strand, between the principal bend of the River Thames and Waterloo bridge. They are separated by several streets, which are distinguished by the family and Christian names of the builders; and the term Adelphi, (from the

Greek *Ἀδελφοι*, *Adelphoi*, brothers,) appropriated to the whole, denotes the fraternal relationship of the parties. All the edifices are erected on arches, which form subterraneous passages from the river to the Strand,—a wide street, following the line of the River Thames, at its principal bend.

Ægean, or *Egean*, Sea, the name given by the ancients to that part of the Mediterranean, between Greece and Asia Minor; called, also, the Grecian Archipelago.

Æneas, a Trojan prince, whose adventures are celebrated by the poet Virgil, in his poem, called the Æneid.

Æolus, the fabled god of the winds.

Æolian, pertaining to Æolia, or Æolis, an ancient name of Thessaly, a country of Greece, and also the name of a colony which migrated from Greece and settled on the west coast of Asia Minor: likewise the name of the islands now called the Lipari Islands, which are said to have been settled by Æolus.

Æolian (or Eolian) *harp*, a stringed musical instrument, which produces its wild and often exquisite sounds by the action of the wind. It is so called from Æolus.

Ælopile, (or Eolipile,) see pages 239, 240.

Alchymy, an art, which originated in Arabia, in the fourth century, and which was afterwards much cultivated in Europe. Its professors were called *Alchymists*, and imagined that gold existed in all metals. It was their great object, to ascertain the manner in which it might be separated from its combinations, and obtained pure; and they expected to find some substance, which would enable them to perform this great operation. This imaginary substance, which some pretended to have discovered, was called the *philosopher's stone*, which they also supposed had the power of curing all diseases, and prolonging and renewing life. Those who studied alchymy pretended to great secrecy; affirming, that some heavy calamity would fall upon any one, who should reveal the principles of the science. Keeping themselves separate from the world, they invented mysterious characters, by which the initiated could hold correspondence, without danger of discovery. Although it is now known that the objects sought by the Alchymists are unattainable, yet they rendered great service to science, and particularly to chemistry; many valuable discoveries having been made, by those who were in the vain and fruitless pursuit of 'the philosopher's stone.'

Alcuin, (or *Albinus*,) Flaccus, a famous English writer, and the most eminent scholar of the age of Charlemagne, who became his pupil and patron. He was brought up under the venerable Bede, and Egbert, Archbishop of York; and, after occupying several important stations, he retired to an abbey at Tours, and spent the remainder of his life in devotion and study, and as an instructer of youth, in a school which he founded in Tours, where he died, on Whitsunday, A. D. 804, aged about seventy years. The Academies of Paris, Tours, and many others, were either founded, enlarged, enriched, or instructed, by him, or through his interest with Charles the Great.

Alexander the Great,—'Macedonia's madman,'—a celebrated King

of Macedonia, who was born three hundred and fifty-six years before the birth of our Saviour, and died in the thirty-second year of his age. He was a great warrior, and conquered his enemies in every battle which he fought; and at last is said to have wept, because "there were no more worlds to conquer." The extent of his conquests, and his uniform success in war, have rendered his name synonymous with *conqueror*. He was proud, ordering himself to be worshipped as a god; and visited the temple of Jupiter Ammon in the Desert of Siwah, and bribed the priests of the temple to declare him to be the son of Jupiter. He was brave, often to rashness; humane and liberal; easy and familiar with his friends; and a great patron of learning. But he was a drunkard; and in one of his fits of madness, produced by intoxication and debauchery, he set fire to the city of Persepolis.

Alexandria, a city of Egypt, which derives its name from Alexander the Great, by whom it was founded about three hundred and twenty-two years before Christ. Under the reign of the Ptolemies, who succeeded Alexander in Egypt, it became the regal capital of Lower Egypt, and a distinguished seat of learning. (*See the next article.*) After Egypt became a Roman province, Alexandria was at one time ranked as the second city of the empire, and contained a population of about six hundred thousand persons. Its modern name is Scanderia; it contains only about sixteen thousand inhabitants.

Alexandria, School of. When the most flourishing period of Greek poetry was past, Alexandria, in Egypt, was made the seat of learning; and King Ptolemy Philadelphus, who died B. C. 247, founded, there, a famous library,—the largest and most valuable one of antiquity,—which attracted many scholars from all countries. The philosophers and scholars, who thus congregated together, formed schools of philosophy and poetry; whence the name, *Alexandrian School*. The time of the Ptolemies is also called the *Alexandrian age*.

Alfred, the Great, see pages 15–19.

Ali, the cousin and son-in-law of Mohammed, who, on his deathbed, appointed him his successor. But this decision of Mohammed being opposed by the partisans of others, Ali retired to Arabia, of which he was Governor, where he made a collection of the doctrines of Mohammed, and, in the year 655, was declared Khalif. He was killed, A. D. 660. He is said, for courage, moderation, piety, (as it was in those days and that country,) and understanding, to have been one of the greatest men that was ever born among the Arabians. The day of his death is annually commemorated by the Persians.

Alkali, (plural *alkalies*,) a substance that has the property of combining with, and neutralizing the properties of, acids, producing salts by the combination. Alkalies change the vegetable blues and purples to green, red to purple, and yellow to brown. *Caustic alkali*, an alkali deprived of its carbonic acid, being thereby rendered more caustic and violent in its operation. This term is usually applied to pure potash. *Fixed alkali*, an alkali that emits no characteristic smell, and cannot be volatilized or evaporated without great diffi-

culty. Potash and soda are called the fixed alkalies. Soda is also called a *Fossil*, or *Mineral Alkali*, and potash, the *Vegetable Alkali*. *Volatile alkali*, an elastic, transparent, colorless, and consequently invisible gas, known by the name of ammonia, or spirits of hartshorn.

Allodial, independent, not feudal, held without any acknowledgement of superiority.

Almagest, or *Almagestum*, see page 200.

Ammonia, volatile alkali. See *Alkali*.

Anaxagoras, a celebrated ancient philosopher, who was born at Clazomenæ, a city of Ionia, about five hundred years before Christ. He disregarded wealth and honors, to indulge his fondness for meditation and philosophy, saying, he preferred a grain of wisdom to heaps of gold. Euripides, Pericles, Socrates, and others of the ancient philosophers, were his pupils. He died at Lampsacus, a city of Mysia, in Asia Minor, in the seventy-second year of his age, B. C. 428. Before his decease, he desired that the boys might be permitted to play on the anniversary of his death ; which request was carefully observed, and the time, thus dedicated to relaxation, was called *Anaxagoreia*.

Ane, an obsolete spelling of one.

Antiquary, a student of antiquity ; a collector of ancient things.

Antiquarian Society, a Society for the collection of Antiquities, or remains of ancient times. That, referred to in this Volume, is called 'The Society of Antiquaries,' and was founded in London, in the year 1751. It has published several volumes of its Transactions, under the title of 'Archæologia,' or Antiquities. It holds its meetings weekly. We have, in this Country, an 'American Antiquarian Society,' which has a valuable library and collection of Antiquities, at Worcester, Mass.

Apocalypse, Revelation, the last book in the Bible.

Arabian, relating or belonging to Arabia, an extensive peninsula, in the southwestern part of Asia, extending into that part of the Indian Ocean called the Sea of Arabia, between the Red Sea and the Persian Gulf.

Arabs, or *Arabians*, inhabitants of Arabia.

Arch, a concave building, with a mould bent in the form of a curve, erected to support some structure ; as the arches of a bridge.

Archduke, the title of a sovereign, whose dominion is called an archduchy ; as Tuscany, and a division of the empire of Austria, called the archduchy of Austria.

Archiepiscopal, belonging to an archbishop.

Archimedes, the most celebrated among the ancient geometricians, born at Syracuse, in Sicily, about two hundred and eighty-seven years before the birth of our Saviour. He was the inventor of several of the most important mechanical powers, such as the compound pulley, the endless screw, &c. ; and is reported to have said he would move the world, if he could find a fulcrum, or point, without it, on which he could stand and place his lever. He is also said to have constructed lenses, or burning glasses, of such great power, that he set on fire with them the ships of the Roman fleet,

which was besieging Syracuse, (referred to on page 58 of this Volume.) Hiero, King of Syracuse, suspecting that an artist had added some common metal to a crown, which he had directed to be made of pure gold, requested Archimedes to ascertain the fact. He discovered the method of solving the question, while he was in the bath, as mentioned in the first Volume of this Work, page 28.

Archytas, a famous Pythagorean philosopher, astronomer, and geometrician, of Tarentum, a town of Apulia, in the south part of Italy. His fellow-citizens had so high an opinion of his virtues, that they seven times chose him governor of Tarentum. He is said to have made of wood, an automaton pigeon or dove, that could fly, and invented many other machines. He is said to have been the first who applied mathematics to human uses. He perished in a shipwreck, about three hundred and ninety-four years before Christ.

Aristotelian, relating to Aristotle, one of the most celebrated philosophers of Greece, who was born three hundred and eighty-four years before Christ, at Stagira, in Macedonia, from which circumstance, he is sometimes called 'the Stagyrite.' He was the preceptor of Alexander the Great.

Ark of the Covenant, the sacred chest or box made by the Israelites, at the command of God, for the reception of the two tables of the law. See Exodus, xxv. 10—22, Deuteronomy, xxx. 26, Joshua, iii. 3, 17, 1 Kings, viii. 9, and other places.

Armenian, belonging to Armenia, a large country of Asia, between the Caspian and Black Seas, south of the mountains of Caucasus, and surrounded by Turkey, Persia, and Russia, which nations now have possession of the whole country. The mountains of Ararat, and the sources of the rivers Tigris and Euphrates, are in this country.

Armida, the name of a beautiful female, mentioned in the 'Jerusalem Delivered,' a celebrated Poem, by Torquato Tasso, an Italian poet. The reference, in this Volume, is to Tasso's description of her palace.

Arminian, relating to Arminius, a celebrated Reformer of the Church, in Holland, and founder of a sect called from him Arminians. He was born, A. D. 1560, and died, A. D. 1609. In Germany and Holland, his followers are generally called *Remonstrants*.

Armory, a place where arms are deposited for use. That, referred to in this Volume, is the public armory in the Tower of London.

Arts, Society of, an Association in London, instituted for the encouragement of the Arts, by offering premiums for useful discoveries, inventions, &c.

Ascetic, a hermit; one who flies from society and lives in retirement; one who practises a greater degree than others do, of mortification and austerity, and extraordinary severities upon himself.

Asiatic, relating to Asia, or an inhabitant of Asia.

Asininus, of, or belonging to, an ass. *Pons Asininus*, the Asses' bridge. The fifth Proposition of the Book of Euclid was so called, because blockheads, or dull and superficial scholars, seldom proceeded further than that, in their mathematical studies, being deterred by the apparent difficulties of the path before them.

Asser, (or Asserius Menevensis,) author of the Life of King Alfred the Great, was born at St. David's, in Pembrokeshire, England. He was invited by Alfred to his Court, and gained so great a share of that King's favor, that he was made Bishop of Sherborn, and Abbot of three monasteries. It is said that it was through his influence with the King, that Alfred was induced to found the University of Oxford. A chronicle, or Book of Annals, was published, A D. 1691, of which he was said to be the author. He died, A. D. 909.

Astronomical Society, an Association established in London, for the improvement of astronomical science.

Athens, a celebrated city and capital of Attica, a country of ancient Greece, founded about one thousand five hundred and fifty-six years before the birth of Christ. It became celebrated as the seat of art, science, literature, and philosophy, and abounded in public buildings of great splendor. Its reputation attracted poets, philosophers, and other persons of literary taste, many of whom there took up their abode, and established schools. Among these, were Socrates, Plato, (who taught in the groves of Academus, see *Academy*,) Aristotle, Zeno, (who taught in the Stoa, or Portico, called Poecile, whence his followers are called Stoics,) and others. The temples, and other edifices, still remaining in Athens, are numerous, and some of them are yet very splendid and wonderful. The temple of Minerva, commonly called the Parthenon, in the ancient acropolis or citadel, has been pronounced the most magnificent ruin in the world.

Bab-el-mandeb, (or *Bab-el-mandel*,) the straits at the mouth or southern end of the Red Sea or Arabian Gulf, communicating with the Indian Ocean. The name literally signifies, 'gate of tears,' and was given to these straits, by the Arabs, on account of their often proving fatal to inexperienced navigators.

Barbour, (John,) an ancient Scottish poet, who was born about A. D. 1316, and died in the year 1378. He was Archdeacon of Aberdeen, and also held other offices. He wrote a celebrated poem called, 'The Bruce, or the History of Robert the First, King of Scotland,' which was not published till A. D. 1616, and has since passed through many editions. It is said to be a work of considerable merit and great value, because he obtained his materials from those who fought under that illustrious King, when he drove the English out of Scotland.

Bagdad, a celebrated city of Turkey, in Asia, situated on the banks of the River Tigris, and on each side of the river. It is the capital of one of the largest provinces in the Turkish empire, and is a place of considerable trade and opulence, containing about eighty thousand inhabitants, of whom, fifty thousand are Arabs.

Bakerian Lecture, a lecture founded by Henry Baker, an ingenious and diligent Naturalist, who was born in London, about A. D. 1700, and died A. D. 1774. He was brought up a bookseller, but did not pursue that profession after he had completed his apprenticeship, preferring to devote his attention to philosophical and scientific pursuits. He was a Fellow of the Antiquarian and Royal Societies, and contributed many valuable papers to the Transactions of the

latter. He was also one of the Founders of the Society for the Encouragement of Arts, Manufactures, and Commerce. He received the Copley gold medal, in 1744. He left to the Royal Society one hundred pounds, the interest of which was to be applied to the support of a lecture on chemistry, or natural history, or philosophy.

Barneage, childhood.

Baron, the oldest degree of nobility. This term was formerly used to include all the greater nobility, and afterwards for the second degree of rank; but is now used for the degree next to that of a viscount, and above that of a baronet; being the fifth degree below the Royal Family. Barons wear a coronet, with six pearls on a gold circle. They are entitled to seats in the House of Peers. There are also officers, called barons.

Basilisk, a kind of serpent, mentioned by the ancients, as found in the African deserts, and so very poisonous, that it killed herbs and fruits by its touch, and even by its breath. It is probable that this serpent was similar to the asp viper. The basilisk of modern Naturalists is a different animal.

Bassora, a city in the northeast border of Arabia, on the River Tigris, and near the head of the Persian Gulf. It is enclosed with a wall, which is eight miles in circuit; but the greater portion of the territory within the wall is laid out in gardens and plantations of date trees. Numerous canals, drawn from the river, traverse it, and are discharged into the river at every turn of the tide; and yet it is said to be the dirtiest town in the Turkish dominions. Its population is estimated at sixty thousand persons, comprising Turks, Arabs, Nestorian Christians, Armenians, and Jews.

Bayle, (Peter,) a celebrated scholar, and author of the Historical and Critical Dictionary, was born at Carla, a small town in France, November 18, 1647, and died December 28, 1706. He was a laborious and indefatigable writer, and his Dictionary has been deservedly admired and valued.

Bede, or *Beda*, surnamed the Venerable, an English monk and eminent writer, who was born about A. D. 672, and died A. D. 735. He became celebrated for his learning, and his fame spread to foreign countries. He wrote an Ecclesiastical History, in the collection of materials for which he spent several years. He also translated the Gospel of St. John into the Saxon language.

Benefice, a benefit or advantage conferred upon a person; an ecclesiastical living; the parochial charge of a clergyman, for which he receives a salary, such as a parsonage, vicarage, rectory, &c.

Biographia Britannicæ, a valuable collection of biographical notices of eminent persons of Britain.

Biographie Universelle, Universal Biography, a valuable French work.

Boethius, (Flavius Anicius Manlius Torquatus Severinus,) a prose writer and poet, who was born at Rome, in the latter part of the fifth century. He studied at Athens, and, on his return to Rome, he was advanced to the highest dignities, being Consul, three times. He wrote many philosophical and other works; the principal of which is his Consolations of Philosophy, which was translated into

English by King Alfred, and Queen Elizabeth, and also by the poet Chaucer.

Board of Longitude, a board of commissioners appointed by the British Parliament, under an act passed in 1714, offering a reward of twenty thousand pounds, (about eighty-nine thousand dollars,) for the discovery of the longitude. These commissioners have given several rewards for improved methods of ascertaining the longitude at sea. The reward of twenty thousand pounds was given to Mr. John Harrison, of London, in 1767, as mentioned in the first Volume of this Work, page 265.

Botanical Garden, a garden for the cultivation of a general variety of plants, particularly rare exotics.

Bourn, the extremity, boundary, or limit, of a country or piece of land, or of any subject.

Bruce, The. The individual, distinguished by this title, was Robert Bruce, King of Scotland, who ascended the throne, A. D. 1306. Previously to his becoming King, his country had been under the dominion of the King of England; but, through the heroic achievements of Sir William Wallace and Bruce, who fought many battles with the English, Scotland was freed from their presence. The achievements of Bruce have been frequently celebrated, both in prose and verse; and he is said by historians to have been scarcely paralleled by any heroes of antiquity; being valiant in war, temperate in peace, meek in prosperity, and undaunted in adversity. He died July 9, 1329, in the twenty-fourth year of his reign.

Brusa, Broussa, Bursa, or *Boursa*, the ancient *Prusa*, capital of Bithynia. The Turks change the P into B, and, refusing to pronounce two consonants together, call it *Bursa*. It was the residence of the Ottoman sultans, before Constantinople was taken. It is situated in a verdant plain, at the foot of Mount Olympus, (in Bithynia,) on the opposite side of the Sea of Marmora from Constantinople. It was always famous for its baths, and admired for the beauty of its situation. It is one of the most populous places in the Turkish empire, containing, as is computed, from forty thousand to sixty thousand inhabitants. It is said to contain no fewer than three hundred and sixty-five mosques, some of which are very beautiful. The baths, also, are said to be handsome structures.

Burgess, a citizen; a freeman of a city or corporate town. The word is sometimes applied to the representative of a corporate town.

Burns, Robert, a celebrated poet of Scotland, an account of whom is given in the first Volume of this Work, pages 307—313.

Buttress, a prop, a support, a wall built to support another wall, and standing out.

Calculus, a department of mathematics,—the science of fluxions. There are different kinds or branches of this science, as the *Differential Calculus*, the *Calculus of Variations*, &c.

Calendar, a register of the year, in which the months and stated times are marked, as festivals and holydays. *Reformation of the Calendar*. The Roman calendar divided the year, at first, into ten months, only, and containing but three hundred and four days;

and afterwards into twelve months of twenty-nine and thirty days each, making three hundred and fifty-five days, and adding an additional month every second year. Afterwards, the Julian Year was introduced. This is a portion of time, consisting of three hundred and sixty-five days and six hours ; so named, from Julius Cæsar, Emperor of Rome, who, about forty-five years before Christ, caused the Roman Calendar to be reformed, and this mode of computing the years to be adopted. But, as the revolution of the earth round the sun, (which is the true and perfect year,) occupies a few minutes less than the time allowed by Julius Cæsar, for a year, it was found, in the course of time, that a whole day was gained in about one hundred and thirty-one years, and in A. D. 1582, ten days had been gained, making the vernal equinox, (or time when the day and night are equal,) happen on the eleventh, instead of the twenty-first, of March. Pope Gregory XIII., who flourished at that time, caused ten days to be taken out of the year 1582, so as to make the vernal equinox fall on the twenty-first of March, as it should fall. This mode of reckoning was not adopted in England, till 1752, when another day had been gained ; and from that year eleven days were taken. The new mode of computation is called the New Style ; and that before in use, the Old Style ; and the years of the New Style are sometimes called Gregorian years, from the Pope who corrected the style. Where the Old Style is still used, the dates are eleven days ahead of ours. Russia is now the only country of Europe, in which the Old Style is still in use.

Caliph, more correctly *Khalif*, which see.

Camera Obscura, literally, a darkened chamber ; the name of an optical instrument, by which the images of external objects, received through a double convex glass, are shown distinctly and in their proper colors, on the wall of, or on a table in, a darkened room.

Candlemas, the feast of the Purification of the Virgin Mary, on the second of February : so called, from its having formerly been celebrated by processions, with lighted candles.

Carbonic acid, a compound of carbon and oxygen.

Cardinal, one of the chief officers of the Church of Rome. The Pope is elected by the college, or body, of Cardinals.

Carthusian, a religious order of monks, founded by St. Bruno, in 1086, who derived their name from the desert of Chartreuse, which is about twelve or fifteen miles from the city of Grenoble, in the southeast of France, and in which they built their first hermitages, which were anciently called Chartreuses. They practised the greatest abstinence, wore coarse garments, and lived exclusively upon vegetables and the coarsest bread. Their habit or dress was entirely white within, covered with a black mantle. Their fifth General, who died in 1137, " prescribed, besides their usual monastic vows, eternal silence and solitude. Mechanical labors, copying of books and religious worship, constituted their occupation. They observed a strict temperance, and submitted to bleeding five times a year. Excessive penance was forbidden, but their laws were very severe against disobedience. They were in general well in-

formed, hospitable, and remarkable for their neatness." The order is now abolished, excepting in Sicily and Spain.

Cashel, an ancient city of Ireland, in the province of Munster; formerly a place of some importance, and the residence of the kings of Munster. It contains the ruins of a very ancient cathedral, supposed to have been the first stone edifice erected in Ireland. It is now a small town, and its trade is inconsiderable.

Castile. The kingdoms of New and Old Castile form the central part of Spain. They were formerly independent kingdoms; but, in the year 1474, they, with the other provinces, were joined, to form the kingdom of Spain, under Ferdinand and Isabella.

Charlemagne, Charles the Great, a celebrated King of France and Emperor of the West, who was born about A. D. 742, at the castle of Ingelheim, near Mentz, and was crowned King of France, A. D. 768, on the death of his father, King Pepin, and Emperor at Rome, A. D. 800. By his victories, he greatly extended the kingdom of France, and, on his becoming Emperor, took the names of Cæsar and Augustus, the two first Emperors of Rome. For his arms, he took the twoheaded or spread eagle, to represent the Roman and German empire, the greater part of which he then possessed. Being delighted with the beauty of Aix-la-Chapelle, in Germany, he selected it for his residence, and died there, January 28, 814, having attained to the age of seventy-two years, of which, he had been King of France, forty-five years, King of Italy, forty-one years, and Emperor, thirteen years. He was a wise, politic, and able Prince, and a great lover of learning and the arts and sciences, as appears from his desire to have all the eminent men of his time around him, and by his founding several universities. He was the author of 'Observations on the Stars,' and several other works.

Charles V., Emperor of Germany and King of Spain, (in the latter capacity, he is called Charles the First,) was born at Ghent, in the Netherlands, February 24, 1500. He "had a noble air, and refined manners; spoke little and smiled seldom; was firm of purpose; slow to decide; prompt to execute; equally rich in resources, and sagacious in the choice of them. Gifted with a cool judgement, and always master of himself, he steadily pursued his purposes, and easily triumphed over obstacles. Circumstances developed his genius and made him great. An acute judge of men, he knew how to use them for his purposes. In misfortune, he appeared greater than in prosperity. He protected and encouraged the arts and sciences, and is said to have picked up a brush which had fallen from the hand of the celebrated painter Titian, with the words, 'Titian is worthy of being served by an emperor.'" He is looked upon as "one of the most remarkable characters in history. He exhibited no talents in his youth, and in afterlife, when his armies in Italy were winning battle after battle, he remained quietly in Spain, apparently not much interested in these victories; but even in his early youth, his motto was, (*nondum,*) *not yet.*" But, from his thirtieth year, to the time of abdicating his throne, he showed himself a monarch. "No minister had a marked influence over him; he was indefatigable in business, weighing the reasons on

both sides of every case, with great minuteness ; very slow in deciding ; unchangeable of purpose. Wherever he was, he imitated the customs of the country, and won the favor of every people except the Germans. He was slow in punishing, as well as in rewarding ; but, when he did punish, it was with severity ; when he rewarded, it was with munificence." He relinquished his right to the Spanish throne, in favor of his son Philip, January 15, 1556, and retired to the monastery of Saint Justus, near Placensia, in the province of Estremadura, in Spain. "Here he exchanged sovereignty, dominion, and pomp, for the quiet and solitude of a cloister. His amusements were confined to short rides, to the cultivation of a garden, and to mechanical labors. It is said that he made wooden clocks, and being unable to make two of them go exactly alike, he was reminded of the folly of his efforts to bring a number of men to the same sentiments. He attended religious services twice, daily, read books of devotion, and gradually fell into such dejection, that his faculties seemed to suffer from it. He renounced the most innocent pleasures, and observed the rules of the monastic life, in all their rigor. In order to perform an extraordinary act of piety, he celebrated his own obsequies. Wrapped in a shroud, and surrounded by his retinue, he laid himself in a coffin, which was placed in the middle of the church. The funeral service was performed, and the Monarch mingled his voice with those of the clergy who prayed for him. After the last sprinkling, all withdrew, and the doors were closed. He remained some time in the coffin, then arose, threw himself before the altar, and returned to his cell, where he spent the night in deep meditation. This ceremony hastened his death," which occurred from a fever, September 21, 1558, in the fifty-ninth year of his age.

Chaucer, (Geoffrey,) one of the greatest, as well as most ancient, of the English poets, born in London, A. D. 1328. He was educated at the University of Cambridge, and afterwards held several public offices. He wrote several works in prose ; and is considered as the "father of English poetry." He died October 24, 1400, and was buried in Westminster Abbey.

Chemical affinity, the attraction or disposition observable between the different particles of bodies, which causes them to unite together, or enter into chemical combination with each other.

Childe Harold's Pilgrimage, the title of a poem, by Lord Byron.

Chinese, inhabitants of, or belonging to, China, an extensive empire in the southeastern part of Asia, containing about five hundred and thirty-seven thousand square miles, and upwards of one hundred and fifty millions of inhabitants.

Cicero, (Marcus Tullius,) the most celebrated Roman orator, and also a statesman and philosopher, who was born at Arpinum, (now called Arpino, and in the kingdom of Naples,) about one hundred and six years before the commencement of the Christian era. He held many public offices, and was, at one time, Consul, or Sovereign of Rome ; but has acquired more real fame by his writings, than by his exertions as a senator and statesman, great though those exertions were, and among which may be mentioned his suppression

of a dangerous conspiracy against the liberty of Rome, by Catiline. He was afterwards banished from Rome, and finally beheaded, by order of his enemies, who had obtained the control of the supreme power. His death took place, December 7, B. C. 43.

Cimabue, (Giovanni,) a celebrated painter, born at Florence, A. D. 1240. He was the first who revived the art of painting in Italy ; and died at the age of sixty years.

Classics, ancient authors of the first rank for purity of language; elegance of style, and excellency of their subject.

Clazomenæ, a city and island in the Gulf of Smyrna, in Asia Minor. There were anciently two cities of this name ; the first, on the mainland, which was strongly fortified ; but the inhabitants being terrified at the defeat of Crœsus, King of Lydia, B. C. 548, they forsook their city and withdrew to the neighboring island, where they built the second Clazomenæ, which is the one so often referred to in history, and which Alexander the Great connected with the mainland by a causeway. It is celebrated as the birthplace of Anaxagoras, the philosopher, and also for its wines, and for a small temple of Apollo, in its neighborhood. There are found here remains of a Mosaic pavement, still in good preservation, and many other remains of ancient times.

Clorinda, one of the heroines in Tasso's Poem of 'Jerusalem Delivered.' The reference in this Volume is to the story of her death, when

> "A smile of transport brightened in her face ;
> Rejoiced in death, she seemed her joys to tell,
> And bade, for heaven, the empty world farewell."

College of Physicians, a medical college, or school, or society of physicians, for instruction in medical science.

Congeries, a collection of several bodies in one mass.

Congreve rocket, an invention, by which balls and other combustibles are discharged to an immense distance ; so called, from its inventor, Sir William Congreve.

Constantinople, the capital city of the Turkish empire, situated at the southeastern extremity of Europe, on the borders of the strait which separates the Mediterranean and Sea of Marmora from the Black Sea ; here the Sultan, or Grand Signior, the supreme ruler of the Turkish empire, resides.

Constellations, the groups or clusters into which the ancients arranged the fixed stars, and to which they gave names according to their fancy, or the appearance which they imagined the groups presented to the eye.

Continent, a large body of land surrounded by water, as the Continent of America, or that containing Europe, Asia, and Africa. *The Continent* is particularly applied to other parts of Europe than England, which is an island. To travel on *the* continent, means travelling on the mainland of Europe, and not in England or any of the islands.

Copernican, relating to Copernicus, (Nicholas,) a celebrated astronomer, who was born in Prussia, January 19, 1472, and died May 24,

1543, aged seventy. He revived the theory of Pythagoras, that the earth and other planets revolve round the sun, as their centre, instead of the earth being stationary, and the sun and planets revolving round it, as was before supposed to be the case. This theory is now universally received as the true one, and is called, from Copernicus, the Copernican system. Copernicus is said to have been also "incomparably skilled in other parts of science and learning, and a perfect master of the Greek and Latin tongues, to all which he joined so much piety and innocence of manners, as might serve for a pattern for all the world."

Copley gold medal. Sir Godfrey Copley, baronet, left to the Royal Society the sum of five guineas, annually, to be given to the person who should write the best paper in the year, under the head of Experimental Philosophy. This reward is now changed to a gold medal, and is the highest honor the Society can bestow. It is conferred at the annual meeting of the Society, on St. Andrew's day.

Cordova, or Corduba, an ancient city of Spain, and formerly the capital of an independent Moorish kingdom, when its population is said to have been not far short of a million. It is situated on the river Guadalquiver. But few vestiges of its former grandeur now remain, except a famous mosque, now converted into a cathedral, which is divided into seventeen aisles, by rows of marble columns, of which there are seven hundred and seventy-eight. Its literary glory was once great, and it was called 'the paradise of booksellers;' but that has all passed away.

Court of King's Bench, the supreme court of common law in England, consisting of the Lord Chief Justice and three inferior judges, who hear and determine, for the most part, all pleas which concern the King's crown and dignity. The King was formerly accustomed to sit in this court, in person; and he is still presumed, in law, to be present, though only represented by his judges; the proceedings in it being said to be *coram nobis*, "before Us," that is, before the King.

Court, the, the residence of the King, Queen, and high officers of government.

Covent garden, or Covent garden market, a large square in London, comprising about three acres, and which may be considered as the emporium of the metropolis for horticultural productions. The north and part of the east sides are occupied by a fine piazza, designed by Inigo Jones, a famous architect; and on the west side is St. Paul's Church, by the same architect.

Covent garden Theatre, a celebrated theatre in Covent garden, London.

Crates, a philosopher of Bœotia, in Greece, about three hundred years before Christ, who sold his estates, and gave the money to his fellow-citizens. He was naturally deformed, and rendered himself hideous, by sewing sheep skins to his mantle, and by the singularity of his manners. He clothed himself as warmly as possible, in Summer, but in Winter was so thinly clad, that his garments were unable to resist the inclemency of the weather. He was a disciple of Diogenes.

Crosier, the pastoral staff of a bishop, made like a shepherd's crook, (but with a cross upon its top,) to denote the similarity of the relation between the bishop and his people to that of a shepherd and his flock.

Cynicism, the disposition of a cynic,—snarling, peevish, satirical.

Czar, the title of the Emperor of Russia. It is derived from Cæsar, the title of the Roman emperors.

Damascus, a celebrated city of Syria, frequently mentioned in the Bible. It is situated about one hundred and thirty-six miles north-northeast from Jerusalem, and contains a population of about one hundred and seventy thousand inhabitants. The situation of the city, in a beautiful valley, well-watered, and surrounded with orchards, has been celebrated with enthusiasm by Oriental writers. The city was formerly famous for its manufactures of sabres, or swords, of a peculiarly fine temper; and the beautiful figured linens and silks, called damasks, take their name from this city. It was on his journey to this city, that St. Paul was converted. See the Acts of the Apostles, Chapters ix. and xxvi.

Danish, pertaining, or belonging, to the Danes, or inhabitants of Denmark, a kingdom of Europe, situated on a peninsula in the North Sea, between Norway and Sweden, on the north, and Hanover and Prussia, on the south.

Danube, the largest river of Europe, rising in the grand duchy of Baden, in Germany, and running through Bavaria, Austria, Hungary, and Turkey, to the Black Sea, into which it empties by five mouths. Its whole length is about eighteen hundred miles, and in its course it receives the waters of about sixty rivers.

D'Anville, (John Baptiste Bourguignon) a famous French writer on Geography, who was born at Paris, A. D. 1702. He is said to have commenced the drawing of maps, at a very early age. He was very much esteemed for the gentleness and simplicity of his manners, and for his extensive knowledge. His maps and plans, of which he published two hundred and eleven, are considered of the highest authority. He also published seventy-eight treatises. He was Geographer to the King of France, Secretary to the Duke of Orleans, &c. He died at Paris, January 28, 1782, aged eighty years.

Dardanelles, the name given to two ancient castles, one on each side of the strait of Gallipoli, (the ancient Hellespont,) or strait leading from the Grecian Archipelago to the Sea of Marmora and Constantinople. The name is sometimes improperly given to the strait itself, which separates Europe and Asia. These castles are called the Old Dardanelles. The New Dardanelles are two forts built by Mohammed the Fourth, A. D. 1659, at the entrance of the strait. The name is supposed to be derived from Dardanus, an ancient city, which stood where the castle on the Asiatic side of the strait now stands.

Dark ages. Before the invention of the art of printing, books were very scarce, and few persons were able to obtain them. Consequently, there was much ignorance in the world. And many of the books, which were written, were destroyed by the ignorant barbarians, who, at one time, spread nearly over the world. The few, that

were not thus destroyed, were preserved in convents, by the monks, who were then almost the only persons who had any learning. These times of general ignorance are frequently termed *the dark ages;* and the period, when people began to pay attention to learning, is called 'the revival of letters.'

Decimal, numbered by ten, or consisting of the number ten. *Decimal fractions*, fractions which have 10, 100, 1000, &c. for their denominator, (or that part of the fraction which stands below the line.) As $\frac{1}{10}$, $\frac{3}{100}$, $\frac{5}{1000}$, signifying one tenth, three hundredths, five thousandths, are decimal fractions. They are usually expressed without the denominators by a point before the numerator, (or that part of the fraction which is above the line.) Thus, .1, .03, .005, are the same as before represented,—one tenth, three hundredths, five thousandths.

Delta, the fourth letter of the Greek alphabet, Δ. The name is applied to those flat tracts of land, found at the mouths of large rivers, and which are formed by the mud which is brought down by the rivers and there deposited. They are so called from their similarity in shape to the Greek letter. The Delta particularly referred to, in this Volume, is that of the River Nile, in Egypt.

Democritus, a celebrated philosopher of Abdera, a city of Thrace. He was born about four hundred and seventy years before Christ, and travelled over the greater part of Europe, Asia, and Africa, in quest of knowledge, and returned home, in great poverty. His fellow-citizens were so much pleased with one of his compositions, which he read to them, that they presented him with a large sum of money, and other marks of their regard. He retired to a garden, near the city, where he dedicated his time to study and solitude; and is said even to have put out his eyes, to apply himself more closely to philosophical inquiries. He died in the one hundred and ninth year of his age.

Denes, *Dunes*, or *Downs*, hills, heaps, or ridges.

De Oratore, of the Orator; the title of a book on Oratory by M. T. Cicero.

Detonation, the noise caused by the explosion of gunpowder, or any other chemical substance.

Diagram, a delineation or drawing of geometrical or other figures.

Diarbekr, Diar-bekir, or the Land of Bekir, a pashalik or province of Turkey in Asia, comprising the greater part of ancient Assyria and Mesopotamia, in the vicinity of the River Tigris.

Dibble, a small spade; a pointed instrument, with which the gardener makes holes in the ground, for planting. *Dibbling*, to plant with a dibble.

Dilettanti, those who delight in cultivating and improving the fine arts.

Diplomatic, relating to ambassadors and envoys, or to the intercourse carried on between different nations through the medium of ambassadors or other agents.

Dispersion of rays of light, the divergence or separation of the different-colored rays in refraction.

Dissenting meeeinghouse, a place of worship of those who have dissented from the Established Church.

Distaff, the staff about which flax is tied in order to be spun, in the old-fashioned spinning-wheels.

Diverge, to proceed from the same point, in different directions, like lines proceeding from a common centre, and constantly growing further apart. *Divergence*, the act of diverging.

Djidda, or Jidda, a seaport of Arabia, on the eastern coast of the Red Sea, forming the port to Mecca.

Dolcignote, belonging to Dolcigno, a town of Turkey in Europe, not far from Constantinople, having a good harbor and a strong citadel.

Doric, the simplest of the orders of architecture ; a species of the ancient music ; the dialect of, or a style common to, the inhabitants of Doris, a country of Greece, and one of the great branches of the Greek nation.

Dormant, sleeping ; concealed.

Ducat, a coin used by several European nations, varying in value, but worth about two dollars and twenty-five cents.

Dunes, see *Denes*.

Dutch, belonging to Holland, the inhabitants of which country are so called. The name is from *Deutsch*, that is, Teutonic, because the Dutch is a dialect of the Teutonic language.

Easel, the stand on which painters place their canvass, when painting.

East. The countries situated in Asia, being east of Europe, are generally spoken of as *the East*, or the Eastern or Oriental world ; as America, being west of Europe, is denominated the Western world. The East has, in all ages, been celebrated for its beautiful fictitious writings ; and has sometimes been called the Land of Genii and Fairies, and other imaginary beings.

East India Company, a corporation, or united company of London merchants trading to the East Indies, chartered A. D. 1600. It is the most wealthy and important company in England, and has the control of the greater part of India. Its charter has many times been renewed ; the latest renewal being in 1834.

Eclat, splendor, pomp, glory, brilliancy, lustre, show.

Edict of Nantz, see *Nantz*.

Elaborately, laboriously ; with great study or labor ; in such a manner as to bespeak elegance, owing to pains and diligence.

Elector, the title of such German princes as formerly had a voice in the election of the Emperor of Germany.

Elector Palatine, the sovereign of a Palatinate or territory in Germany possessing royal privileges.

Electric, attractive by a peculiar property called Electricity. *Electric current*, or *Electric fluid*, a fine, rare fluid, supposed to issue from and surround electrical bodies.

Electricity, the science which treats of the electric power. Lightning is the sensible appearance of the electric fluid.

Electrified, rendered electric.

Electro-Chemistry, a new science, which regards the supposed action of electricity in the production of chemical effects, the principles of which were discovered by Sir Humphrey Davy, and for which the French Institute awarded their first prize. See page 110.

Elephanta, an island in the East Indies, about eight miles from Bom

bay, which derives its name from the figure of an elephant seven feet high, carved out of white stone, and so like to nature, that at a little distance it may easily be taken for a living animal. There are also many other figures, carved in the stone, and of an immense size.

Elixir Vitæ, elixir of life; a universal medicine, which the Alchymists pretended was capable of prolonging life.

Ell, a measure of length, different in different countries. The English ell is three feet and nine inches, or a yard and a quarter; the Flemish ell is two feet and three inches, or three quarters of a yard.

Elysium, the place assigned by the heathens for the happiness of souls after death.

Enfeoff, (a law term,) to invest with any dignities or possessions.

English Church, the Established or Episcopal Church of England, governed, as is the Episcopal Church in this country, by the three orders of the ministry, bishops, priests, and deacons.

English Money is calculated in pounds, (marked £.,) shillings, pence, and farthings. There are also guineas and crowns.

A pound contains 20 shillings, and is now worth about 4 dollars 87 cents.
" shilling " 12 pence " " 24½ "
" penny " 4 farthings " " 2 "
" farthing is worth about . . . . . ½ "
" guinea is worth about 5 dollars 07 cents. A crown, about 1 dollar 15 cents.

Ephemerides, astronomical tables, showing the state of the heavenly bodies for every day, at noon.

Equipoise, equilibrium, equality of weight.

Estuary, an arm of the sea; the mouth of a lake or river into which the tide comes.

Eton, a town in England, on the River Thames, and not far from London, celebrated for a beautiful college, founded, A. D. 1441, by King Henry the Sixth, for the gratuitous preparation of students for the University of Cambridge. These scholars are nominated by the King, and are hence called King's scholars.

Euclid, a celebrated mathematician, who was born in Alexandria, in Egypt, about two hundred and eighty years before Christ. He distinguished himself by his writings on Music and Geometry. The most celebrated of his works is his 'Elements of Geometry,' which is in use at the present day. He established a school at Alexandria, which became so famous, that, from his time to the conquest of Alexandria by the Saracens, (A. D. 646,) no mathematician was found, who had not studied at Alexandria. Ptolemy, King of Egypt, was one of his pupils; and it was in answer to a question of this King, whether there was not a shorter way of coming at Geometry, than by his Elements, that Euclid made the celebrated answer, that "there is no royal way, or path, to Geometry."

Euler, (Leonard,) an eminent mathematician, born at Basil, in Switzerland, April 14, 1707. He was appointed Professor of Natural Philosophy in the Academy of St. Petersburg, in 1733. The catalogue alone, of his works, occupies fifty pages. He died September 7, 1783, in the seventy-seventh year of his age.

Euripides, an ancient Greek tragic poet, born in the island of Salamis, about four hundred and eighty years before Christ. He wrote a great number of tragedies, which were highly esteemed.

He was invited to the court of Archelaus, King of Macedonia, where it is said he became Prime Minister. While one day walking in a wood, in deep meditation, he was met by the hounds of Archelaus, who tore him to pieces, in the seventy-fifth year of his age.

Euridice, the name of several ancient females. The one alluded to on page 150 of this Volume, was the wife of the Poet Orpheus. She was bitten by a serpent in the grass, and died of the wound. Her husband was so disconsolate, that he is fabled to have descended into the place of departed spirits, where, by the melody of his lyre, he obtained from the judge of those regions the restoration of his wife, provided he did not look behind him, till he came to the earth. His eagerness to see his wife made him forget this condition, and, looking behind him, she was for ever taken from him.

Exhibition, an allowance, or pension, given in the English universities to necessitous students, from the proceeds of funds bequeathed by benefactors for the encouragement of learning.

Fahrenheit, a celebrated natural philosopher, born at Dantzic, A. D. 1686. He was eminent for his great improvements in the construction of the thermometer, an instrument used to ascertain the temperature of the air, liquids, and other bodies. The inventor's name is sometimes used for the instrument.

Fee, or feud, a possession, an estate of inheritance, or the perpetual right or interest which a man has in land or some other immovable, on condition of some acknowledgement paid to the lord of the manor.

Fee-simple, an estate held by a person in his own right, he having a complete title and possession, and the estate descending to his heirs or assigns.

Fellow, of a college, or of a society, a member who shares its revenue and enjoys its privileges.

Feoff, to put in possession ; to invest with right.

Feudal, dependent ; pertaining to fees or tenures by which lands are held of a superior. Formerly, none but the king and other great personages owned lands, and all others held them as dependents of the owner, and were bound to render him certain services for their use. This was called holding the lands by feudal tenure.

Fezzan, a kingdom of Moorish Africa, (or that part of Africa inhabited by Moors,) situated south of Tripoli, about three hundred miles from the Mediterranean Sea, and containing, it is supposed, about seventy thousand inhabitants.

Field Marshal, the officer of highest military rank.

Fire-Damp, an inflammable gas found in coal mines, and which sometimes explodes, destroying all who may at the time be in the mine. Sir Humphrey Davy constructed a sort of lantern, called a safety-lamp, which miners are enabled to use, without fear of the gas taking fire from their light ; an invention or discovery, which has been the means of saving the lives of thousands.

Fixed alkali, see *Alkali*.

Flanders, a country of Europe, situated partly in France and partly in the Netherlands. Its limits have often varied, and the territory

has been variously divided under the distinguishing appellations of French, Dutch, and Austrian Flanders. The inhabitants are called Flemings, and the language Flemish.

Florence, the chief city of Tuscany, in Italy, on the river Arno, formerly the first city of Europe, for her arts, her letters, and the independent character of her citizens. "Every corner of this beautiful city is full of wonders, in the arts of painting, statuary, and architecture. The Chapel of St. Lorenzo is perhaps the finest and most expensive habitation that was ever reared for the dead. It is incrusted with precious stones, and adorned by the workmanship of the best modern sculptors. The city contains one hundred and fifty churches, eighty-nine convents, twenty-two hospitals, seventeen squares, and one hundred and sixty-two public statues. The number of inhabitants is calculated at eighty thousand." It has a celebrated Academy, or Association of Learned Men, called the Academia Florentina, or Florentine Academy, established A. D. 1542, a University, and other literary institutions. The Medicean Gallery, or Gallery of Florence, is a grand collection of works of art, and celebrated throughout Europe. It is more than five hundred feet long, and filled with busts, statues, and paintings. Florence was the native place of Dante, Americus Vespucius, and other distinguished individuals.

Fluxions, that branch of mathematics, which treats of the analysis of infinitely small quantities, showing the velocity with which they increase or decrease.

Fly-shuttle, or flying-shuttle, (so called, probably, from the swiftness of the motion of the shuttle, when it is used,) an instrument used in weaving, for throwing the cross threads.

Fordun, (John de,) a Scottish historian, who flourished in the fourteenth century, and wrote a history of Scotland, with the title of 'Scoti-Chronicon,' which was published about the year 1377.

Franciscan, a religious order of monks, founded in 1208, by St. Francis, of Assisi, in Umbria. The Order was originally distinguished by vows of absolute poverty, and a renunciation of all the pleasures of the world. Their common dress is a coarse woollen frock, with a cord round the waist, to which is suspended a rope with a knotted scourge.

Fresco painting is executed on fresh plaster, or on a wall laid with mortar not yet dry, so that the colors will dry in the mortar or plaster, and become permanent.

Friesland, or country of the Frisons, a name anciently applied to the Netherlands and part of Germany, which was divided, by the gulf called the Zuyder Zee, into East and West Friesland. The name is now confined to a smaller portion of this tract.

Frisian, belonging to Friesland or the Frisons.

Galileo Galilei, a celebrated astronomer, mathematician, and natural philosopher, who was born in Florence, (or, as some say, at Pisa,) a city of Tuscany, in Italy, February 19, 1564. He was the son of a nobleman of Florence, and received an education suitable to his birth, his taste, and his abilities. His progress in the sciences was extraordinary, and at twenty-five years of age, he was appointed

Professor of mathematics in the University of Pisa, and, three years after, was invited to a similar professorship, at Padua. He made many important observations and discoveries in science, and on hearing that an instrument had been discovered in Holland, by which distant objects could be easily perceived, his curiosity was raised, and the result of his investigations was the production of a telescope of his own, without ever having seen the Dutch glass. With this instrument, he made many astronomical discoveries, and established, beyond the possibility of doubt, the truth of the Copernican system. But his discoveries drew upon him the jealousy of the Jesuits, who denounced him as a heretic, and he was in consequence subjected to much suffering, and was imprisoned in the dungeons of the Inquisition. When released from prison, he pursued his researches, with such diligence, that he became blind. The loss of his sight, however, neither broke his spirits, nor hindered the prosecution of his studies, for the remaining three years of his life. He died, January 8, 1642, in the seventy-eighth year of his age.

Gallery, a room particularly constructed for the exhibition of paintings and other works of art. The Galleries of Florence and Venice, particularly alluded to in this Volume, contain choice collections of paintings and sculpture. See *Florence* and *Venice*.

Gallipoli, strait of, the ancient Hellespont. See *Dardanelles*.

Galvanic, relating to *Galvanism*, a branch of the science of electricity first discovered by Galvani, a professor of Bologna, whence its name. The electricity is not developed by the aid of friction, but by a chemical action which takes place between certain bodies, such as plates of different metals, separated by moist pieces of cloth or an acid mixture.

Gas, a name applied to the different species of air, as oxygen gas, coal gas, &c.

Gaul, or *Gallia*, the ancient name of France.

Genius, (plural, *Genii*,) a supposed supernatural being, still believed, in the East, to influence the affairs of men.

Good, to manure. *Gooding*, manuring.

Gossamer, a fine filmy substance, like cobweb, which is often seen in the fields on clear days, probably made by a spider, called the flying spider.

Greenwich hospital, an establishment founded by King William and Queen Mary, of England, for invalid seamen. It is situated at Greenwich, on the south bank of the River Thames, about five miles from London. The present establishment consists of two thousand seven hundred and ten pensioners, one hundred and sixty-eight nurses, and a variety of officers of the hospital ; and gives relief to thirty-two thousand out-pensioners, or those who reside at their own homes.

Gregorian telescope, the reflecting telescope, so called from its inventor, James Gregory, an eminent optician and mathematician, who was born at Aberdeen, in Scotland, in November, 1638, and died in October, 1675, at the early age of thirty-seven years. See *Telescope*.

Gresham college, an establishment in London, founded by Sir Thomas Gresham for the promotion of science. Professors of divinity, law,

physic, astronomy, geometry, music, and rhetoric, deliver gratuitous lectures to the public, twice a day, during term-time; but, owing to a want of proper arrangement, but little advantage results from the establishment.

Guinea, see table of *English Money*.

Hackney, a town in England, on the north side of London, from which Hackney coaches derived their name. Many people from London being in the practice of visiting their friends in this town, and often hiring horses and coaches for this purpose, it became a common practice to designate such horses and carriages by the term Hackney, which has now become a common name, not only in Great Britain, but in this country.

Haleb, or Aleppo, the chief city in Northern Syria, situated about eighty miles from the Mediterranean. Two hundred years ago, its population was estimated at nearly three hundred thousand persons; but it has since rapidly declined. It has suffered much from earthquakes. In August, 1822, the greater part of the city was destroyed, by successive shocks, which continued for above a month. In one of the convulsions, it is computed that at least twenty thousand persons perished, and an equal number were maimed by the falling buildings. In a work, entitled 'Scenes in Nature,' forming Volume vii. of the Juvenile Series of 'THE SCHOOL LIBRARY,' there is an interesting account of this catastrophe.

Hamjarish, *Hamjarine*, or *Ham-yaric*, an ancient dialect of the Arabic language, so called from the dynasty of Ham-yarites or Homerites, or princes of the country of Himiar or Hamyar. "The history of these princes," says Niebuhr, "is so involved in obscurity, that we are ignorant even of their origin, and know not to what nation they properly belonged." It is supposed, however, that Hamyar, the founder of the family, began to reign about the year 1698 before Christ, or about the end of the seven years of famine during which Jacob and his family migrated to Egypt. Hamyar is said, by some historians, to have been the fourth in descent from Joktan, the son of Eber, mentioned Genesis x. 25, 26.

Harmonics, that branch of music which considers the differences and proportions of sounds.

Hatching, shaded by deep lines, in drawing or engraving.

Hebrew, the language of the Jews or Hebrews.

Hellespont, the narrow strait leading from the Ægean Sea, or Grecian Archipelago, to the Sea of Marmora, and lying between Europe and Asia. The Castles of the Dardanelles are situated one on each side of this strait. See *Dardanelles*.

Herbarium, or Herbal, a book, containing the names and descriptions of plants; a book containing dried specimens of plants. In the latter sense, more properly called *hortus siccus*, or dry garden.

Hetman, the title of the chiefs of the different tribes of Cossacks, who inhabit the country called the Ukraine, (that is, the frontier,) a tract of country bordering on Russia, Poland, and Turkey.

Hiero, a king of Syracuse, the friend and patron of Archimedes, who died about two hundred and twenty-five years before the Christian era, in the ninety-fourth year of his age. He was universally re-

gretted; and the Sicilians showed, by their lamentations, that they had lost a common father and friend. See *Archimedes*.

Hindoos, original inhabitants of Hindostan, or Hindoo-stan, in India.

Holy orders, the ministry in the Episcopal Church, consisting of the three orders, bishops, priests, and deacons.

Homer, a celebrated Greek poet, who is supposed to have flourished from eight hundred to one thousand years before Christ. But little satisfactory is known respecting him, and the time and place of his birth and death are alike unknown. He was the author of the 'Iliad,' a poem upon the Trojan War, or war in which the city of Troy was destroyed; and the 'Odyssey,' in which he describes the return of Ulysses, a Grecian Prince, from the Trojan War, and the adventures which befel him during his voyages. He is said to have been blind. See *Troy*, and *Trojan War*.

Horace, or *Horatius*, (Quintus Flaccus,) an ancient Roman poet, who flourished in the reign of the Emperor Augustus, and was born about sixty-five years before Christ, at Venusium, a town of Apulia, in Italy. After completing his education, (which was begun under the best masters that Rome afforded, and finished at Athens,) he entered the Roman army, and was made an officer by Brutus. He did not gain any credit, however, in this service; and, leaving the army, and becoming poor, he applied himself to poetry, in which he succeeded so well, that he soon became eminent, and was patronised by the Emperor. His poetry, though much admired for its elegance and sweetness, is yet deservedly censured for its licentious expressions and indelicate thoughts. He was witty and satirical, warm in his friendship, and fond of retirement, in which he spent the last years of his life. He died about eight years before Christ.

Hudibras, a much celebrated satirical poem, written by Samuel Butler, an English poet, who was born A. D. 1612. The poem was published in 1663. Its hero was Sir Samuel Luke, a commander in the army of Oliver Cromwell, with whom Butler resided for some time.

Hydraulics, the science which treats of the motions of fluids.

Hydrogen, a very light, inflammable gas, of which water is, in part, composed. It is used to inflate balloons.

Ingine, ingenuity.

Inquisition, a tribunal, or court, in some Roman Catholic countries, for the suppression of heresies. It was at one time very powerful. It conducted all its investigations in secret, employing the most cruel tortures to compel its victims to confess the crimes with which they were charged.

Institute of France, or the National Institute, a learned body, which was organized after the commencement of the French Revolution, when the other Academies of learning and arts in the kingdom had perished. Its object was the advancement of the arts and sciences, by continual researches, by the publication of new discoveries, and by a correspondence with the most distinguished scholars of all countries. It received its final organization in 1803, though it was somewhat modified, on the restoration of the Bourbons, in 1816

Ionia, an ancient country of Asia Minor, bordering on the coasts of the Grecian Archipelago, or Ægean Sea. It contained thirteen flourishing cities, only one of which, Smyrna, retains any portion of its ancient consequence.

Islam, or *Islamism*, the true faith according to Mohammedans; the name by which Mohammed designated his faith when he first began to promulgate his doctrines.

Italian, belonging to, or a native of, Italy.

Jacobite, one attached to the cause of King James the Second of England, after he abdicated the throne.

Jaffa, or *Yaffa*, the present name of Joppa, a place mentioned in the Bible, situated on the seacoast, about seventy miles from Jerusalem. It was the seaport of Palestine; and here, the Prophet Jonah embarked for Tarshish, when he attempted to flee from the Lord. It was in this place that St. Peter lived, for some time. He dwelt with one Simon, a tanner, who lived near the seaside. A spot, where his house *is said* to have stood, is still shown to strangers.

Janizary, formerly one of the guards of the Grand Signior, or Sultan, of the Turks. This corps is now abolished.

Jerim, a small town in the interior of Arabia, about one hundred miles northeast of Mokha on the Red Sea.

Jesuits, the name given to a learned order of Roman Catholic priests, who acquired great power and influence in Europe, which they maintained for a long time. Their name means, followers of Jesus; but, in their zeal for the outward forms of his religion, and their love of power, they forgot his meek and holy spirit, and became cruel persecutors and oppressors of all those who thought differently from themselves.

Kahira, or *Alkahira*, the proper name of the renowned city of Cairo, the capital of Egypt.

Karek, a small island in the Persian Gulf, celebrated for its pearl fishery. The Dutch have a settlement here, and all vessels bound up to Bassora must here take pilots.

Kepler, John, an eminent German astronomer and mathematician, born at Wurtemburg, December 27, 1571. He made a celebrated set of astronomical tables, which were called the 'Rudolphine tables,' from the Emperor Rudolph; and pointed out the laws that regulate the courses of the planets, which are known as the 'Laws of Kepler.' These laws were the foundation of the discoveries of Newton, and the theory on which the true system of the planetary motions has since been founded. Kepler died in November, 1630, in the fifty-ninth year of his age.

Khalif, or *Caliph*, literally, a successor, the title of the supreme ruler of the Mussulmans, as the successor of Mohammed.

Kiel, or *Kiell*, a strong, rich, and commercial town of Germany, in Lower Saxony, and capital of the duchy of Holstein, with a castle and a university. It is situated at the mouth of the river Swenthin, in the Baltic Sea, thirty-seven miles northwest from Lubec and forty-six north of Hamburg.

King's Bench Court, see *Court of King's Bench*.

Koptish, or *Coptish*, relating to the Copts, or Egyptian Christians, who still retain, in their sacred books, the Coptic language.

Koran, or *Al Koran*, the sacred book of the Mohammedans.

Kossir, a town in Upper Egypt, on the coast of the Red Sea.

Lambeth, a town on the River Thames, opposite to London, where the Archbishop of Canterbury has a palace, and where the ecclesiastical records are kept.

Larnica, one of the chief towns of Cyprus, the most easterly island of the Mediterranean.

Latin, the language of the ancient Romans.

Leipzig, or *Leipzic*, a city of Upper Saxony, sixty-four miles north of Dresden, and ninety south of Berlin, containing a population of about thirty-five thousand persons. Its University is one of the most celebrated in Germany; and it carries on the largest book trade, probably, of any place in the world. Upwards of fifty booksellers reside in the city; and from two to three hundred from other places visit it, once a year, at a great fair at Easter.

Leon, a city of Spain, the capital of the first Christian kingdom founded in the country after it was conquered from the Moors, and which was united to the kingdom of Castile, A. D. 1030. The title of kingdom is still given to the territory.

Loheia, a city of Arabia, on the coast of the Red Sea.

Longitude, Board of, see *Board of Longitude*.

Lozenge, a diamond-shaped figure, a rhomb.

Lusatia, a province of the German empire, surrounded by Brandenburg, Bohemia, Silesia, and part of Saxony.

Madonna, a name given to a picture of the Virgin Mary.

Mair, more.

Mall, a kind of hammer or beater, used in a game to strike a ball. The name is sometimes used for the game itself, and is also now commonly applied to the walk where the game used to be played.

Manipulation, an operation performed by the hand.

Marcellus, (Marcus Claudius,) a famous Roman general, who was born about two hundred and sixty-seven years before Christ. He was famous for his valor, and was called the sword of the Romans. He was five times consul of Rome. He was killed, in the sixtieth year of his age.

Marmora, Sea of, a small sea between the Ægean and Black Seas; connected with the former by the strait of Gallipoli, and with the latter by the strait of Constantinople, anciently called the Thracian Bosphorus.

Mascat, the principal port on the eastern coast of the Arabian peninsula, below the Persian Gulf.

Mecca, a city of Arabia, in Asia, celebrated as the birthplace of Mohammed; it is about a day's journey from the Red Sea. It is entirely supported by the concourse of pilgrims from every part of the Mohammedan world, who annually flock thither to visit the temple within which is the Kaaba, or house of the Prophet.

Media, plural of *Medium*.

Medici, the name of a wealthy family in Florence, who were such great patrons of literature, that the period in which they lived was

termed the *Medicean age*. Cosmo de' Medicis, the founder of the family, was born A. D. 1399, and died A. D. 1464. His public services were such, that over his tomb was inscribed, 'Father of the People,' and 'Deliverer of his Country.' His grandson, Lorenzo, was born A. D. 1448, and died A. D. 1492. He was surnamed, 'the Magnificent,' and 'Father of Letters.'

Medina, a city of Arabia, situated about two hundred miles north of Mecca, and about a day's journey from the Red Sea. It is celebrated as being the city to which Mohammed fled from Mecca, A. D. 622, when a conspiracy was formed against his life. It is from this *flight* (in Arabic, Hegira) that the Mohammedans commence their reckoning. Mohammed died here, and his tomb is visited by his followers.

Mediocre, middling; second-rate; of moderate degree.

Mediterranean Sea, a great body of water, separating Europe from Africa and Asia. The countries on its borders were very early settled, and, for a long time, almost all the commerce of the world was confined to this Sea.

Mendicant, a beggar; a monk who subsists upon alms acquired by begging.

Mercury, a heathen deity, said to be the god of eloquence and commerce, and the messenger of the other gods. He is generally represented with wings on his heels and hat, to denote the swiftness of his movements, and a caduceus, or wand, entwined with two serpents and having wings at the top. The serpents are supposed to denote prudence.

Mezzotinto, a kind of engraving; so named, because it nearly resembles paint, the word meaning half-painted.

Mohammed, a celebrated impostor, who was born at Mecca, in Arabia, in the year of our Lord 569, and who, in the year 609, announced himself as the Apostle, or Prophet, of God. His doctrines were widely disseminated, by means of violence and the sword; and, to this day, they extensively prevail in Asia and Africa. He died at Medina, in Arabia, A. D. 632, where his tomb is still to be seen. He pretended that he made a journey to heaven.

Mohammedan, a follower of, or believer in the doctrines of Mohammed.

Moldavia, a country of southern Europe, lying between Austria, Russia, and Turkey, and now divided between the latter two powers.

Moorish, relating to the Moors.

Moors, a class of the inhabitants of Western Africa, particularly of Fez and Morocco. The name was given to them by the Spanish writers, who derived it from *Mauritania*, as that part of Africa, which they inhabited, was called by the Romans. They held dominion in Spain, for eight hundred years; and were finally conquered, and their kingdom of Granada subdued, in 1491, by Ferdinand, after a ten years' war. After their subjugation, a part of them "went to Africa; but most of them remained in Spain, where they were industrious, peaceful subjects, and adopted generally the external forms of Christianity. The latter were called in Spain Moriscos. Philip II., in his ferocious zeal for Christianity, resolved upon

their entire destruction. His oppressions and persecutions excited an insurrection of the Moriscos in Granada, (1571,) after the suppression of which, over one hundred thousand of them were banished. Philip III., in the same fanatic spirit, completed their expulsion, and nearly a million of them emigrated to Africa. As they were the most ingenious and industrious inhabitants of Spain, they were a great loss to the country. Agriculture speedily fell into decay, and their expulsion is regarded as one of the leading causes of the decline of Spain."

Mooted, discussed; argued upon a supposed case.

Mosses, morasses, or boggy places.

Mount Lebanon, the highest mountain in Syria; very often mentioned in the Bible.

Mull, one of the western islands of Scotland.

Muriatic acid, spirit of salt; an acid composed of chlorine and hydrogen.

Nantz, (or Nantes,) *Edict of*, an edict or proclamation of Henry the Fourth, King of France, A. D. 1598, in favor of the Protestants; so called from its being issued from Nantz, a maritime city of France, situated upon the coast of the Mediterranean. The revocation of this edict, by Louis the Fourteenth, A. D. 1685, inflicted a fatal blow upon the manufacturing interests of France, by driving from the kingdom the great body of Protestants, many of whom were manufacturers.

National Institute, see *Institute*.

Natolia, (more properly *Anatolia*,) a province of the Turkish empire, extending over the western part of Asia Minor.

Neapolitan, belonging or relating to Naples, a city of Italy, in a kingdom of the same name.

Newton, Sir Isaac, see Index.

Niger, a great river of central Africa, the source of which is in the western part of the Continent. Its course and termination have alike been matter of doubt and uncertainty, till within a few years. Many expeditions have been made, from time to time, to ascertain its course; but, till lately, without success. It is now found to discharge itself into the Gulf of Benin, on the coast of Guinea, and to pursue a course, the length of which cannot be far from twenty-five hundred miles.

Nile, the only river of Egypt. It is formed by the union of two large rivers from the interior of Africa, which unite in Nubia, and, flowing through Egypt, empty into the Mediterranean Sea. It annually rises to a sufficient height to overflow the surrounding country, and the mud and slime brought down from the mountains by its waters, and thus deposited over the land, imparts to the soil a wonderful fertility. The whole length of this river is probably not far from two thousand miles.

Nilometer, a pillar erected in the middle of the Nile, on which are marked degrees, measuring the ascent of the water.

Nitric acid, an acid composed of oxygen and nitrogen.

Nitrogen, or *azote*, a simple, invisible, aeriform substance, or gas, which composes four fifths of the atmosphere, and is a constituent

part of nitric acid, ammonia, &c. It does not support respiration nor flame.

Nitrous oxide, a compound of nitrogen and oxygen gases, which, on being respired, produces an exhilaration or excitement, like the early stages of intoxication.

Novum Organum Scientiarum, a new method of employing the reasoning faculties in the pursuit of truth; the title of a work by Lord Bacon.

Nubia, a country of eastern Africa, south of Egypt, bordering on the Red Sea, and having the Desert on the west. It contains about one hundred thousand inhabitants.

Old Jewry, a street in London.

Oman, or *Omaun*, a territory extending along the eastern coast of the Arabian peninsula, at the entrance of the Persian gulf. Mascat is the principal place.

Omar, a famous Khalif of the Saracens, the second after Mohammed, and one of the most rapid conquerors in modern history. He was assassinated, A. D. 643, in the sixty-third year of his age.

Opus Majus, greater work; a collection of the principal writings of Roger Bacon, made by himself, at the request of Clement the Fourth, Pope of Rome.

Oriental, eastern.

Orpheus, a fabulous poet and musician of antiquity, who is said to have had so much skill in music, that he moved savage beasts to forget their wildness, and all Nature seemed charmed with his song. He was the husband of Eurydice, and his descent into the grave to seek her has already been mentioned. (See *Eurydice*.) It is supposed, by some, that this fable originated in the circumstance that Orpheus was greatly skilled in medicine, and by that skill preserved the life of Eurydice, or, in other words, snatched her from the grave.

Ottoman, the title given to the empire of the European Turks, from the name of the founder of the empire, Othman, or Osman. The proper national appellation is Osmanli.

Oxford, a city of England, the seat of a celebrated university, the most richly endowed literary institution in the world.

Oxide, any substance combined with oxygen, in a proportion not sufficient to produce acidity; example, rust of metals.

Oxidize, to combine oxygen with a body without producing acidity.

Oxygen, vital air; a simple and very important substance, which exists in the atmosphere, and supports the breathing of animals and the burning of combustibles.

Oxygen gas, oxygen converted into gas by combining with caloric.

Palatinate, the territory of a count palatine. The name is particularly applied, in this Volume, to two provinces of Germany, called the Upper and Lower Palatinate, bordering on Switzerland and France.

Palatine, possessing royal privileges.

Palestine, unquestionably the most memorable and interesting country on the face of the whole earth; the land most sacred to our recollection, as men and as Christians; at once the most favored and the most guilty country under heaven; which was, between

two and three thousand years, the only portion of the world where the worship of the true God was maintained ; the scene of nearly all the important events recorded in the Bible ; where the Lord of glory lived, and taught, and suffered ; to which the banished Jew looks, as to his long-lost home ; and the devout Christian, for the completion of prophecies yet to be accomplished ;—this most interesting country is a small canton in the southwest part of Syria, bordering on the Mediterranean Sea. It is also called the Holy Land, the Land of Judea, Israel, Canaan, &c. Jerusalem is its capital,—a city which was founded about the year B. C. 2023, and which, having survived the revolutions of more than four thousand years, is still an important city, in our own day.

Parliament, the appellation by which the Legislature of Great Britain is ordinarily designated. It is composed of the House of Lords, and House of Commons.

Parsees, a colony of ancient Persians, in and near Bombay and Surat, in India, who took refuge there when their country was conquered by the Mohammedan Arabs. They pay worship to the sun, moon, and stars, and to fire, as visible images of the invisible Deity.

Pasha, a Turkish viceroy, or governor of a territory called a pashalik.

Patent, an abbreviated expression, signifying letters-patent, or open letters, or grants of the government, under the great seal thereof, granting some right, privilege, or property, to a person, who is thence called the *Patentee*. Thus, the government grants the public lands, by a patent, to the purchaser. So, a copyright in a book, or an exclusive right to an invention, is granted by a patent. When the word patent is used in conversation, it is ordinarily limited to a patent-right for an invention.

Pedestrian, on foot ; one who journeys on foot.

Pehlwi, *Pehlvi*, *Pehlevi*, *Pehlo*, or *Pehluwan*, an ancient dialect of the Persian language. The name signifies, the language of heroes.

Pericles, a celebrated Grecian statesman, who was for forty years at the head of the Athenian government. He was born about five hundred years before Christ, and died in the seventieth year of his age. During his life, the arts and sciences were in their most flourishing condition in Greece, and this period of history is frequently termed the Periclean age.

Persepolis, a royal city of Persia, in the time of Alexander the Great, who set fire to the palace, at the instigation of one of his licentious female favorites. The supposed remains of this palace are still to be seen. Thirteen pillars are yet standing, and vast masses of shattered columns and fragments are scattered over an extensive area, the sculptures on which are of the highest interest and historical value.

Persian Gulf, a large bay on the southwest border of Persia, connected with the Indian Ocean. The river Tigris, having been joined by the Euphrates, empties into the northern part of this gulf.

Perth, a city of Scotland, in a county of the same name. It was formerly a royal residence.

Petard, a metallic pot, or instrument of warfare, almost in the shape of a hat, fixed upon a strong, square plank. When charged, it is fixed, by an iron hook, to a gate or barrier, and on being discharged, breaks every thing about it, and thereby makes an opening to enter the place.

Phœnicians, inhabitants of Phœnicia, a territory in Syria, on the eastern coast of the Mediterranean, and northwest of Palestine, the principal cities of which were Tyre and Sidon. The Phœnicians were early celebrated as adventurous mariners, and the invention of letters is attributed to them. They planted colonies on the shores of the Mediterranean, particularly Carthage, Hippo, Marseilles, and Utica, and their manufactures acquired such a superiority over those of other nations, that among the ancients whatever was elegant, great, or pleasing, either in apparel or domestic utensils, was called Sidonian. In the time of Solomon, it is said, there were "none who were skilled how to hew timber like the Sidonians;" the navy of Tyre was greater than that of any kingdom in the world, and her "merchants were princes."

Piazzetta, (Italian, diminutive of Piazza, a square,) the little Piazza; the name of a small square in Venice, adjoining the Piazza, or large square of St. Mark's.

Plato, a celebrated Greek philosopher, born about 429 B. C. He died on his eighty-second birthday. His name was given him, (from a Greek word, signifying *broad*,) on account of the breadth of his chest and forehead.

Polish, relating, or belonging, to Poland, a country of Europe, consisting of a vast plain, extending from the Carpathian Mountains, which separate it from Hungary, to the Prussian territory on the north, having Russia on the east, and Germany on the west. No country in Europe has undergone so many changes as this. Its national character is now fast disappearing, under the dominion of the Russians; and the Polish name will probably soon be extinct, except in history, from which, the record of splendid and chivalrous achievements by the Poles, their learning and literature, cannot be effaced. Copernicus was a Pole.

Potash or Potass, an alkali, composed of oxygen and potassium.

Potassium, a light and very inflammable metal discovered by Sir Humphrey Davy, in potass.

Precogitate, to consider beforehand.

Principia, first principles; the title by which Newton's great work on the first principles of mathematics and natural philosophy is usually known.

Proclus, an eminent philosopher, born at Constantinople, A. D. 410. He was the Rector of the Platonic School at Athens, where he died, A. D. 485. He wrote a vast number of works.

Protégé, favorite, fondling, dependent; a person protected and patronised.

Ptolemy, a celebrated geographer, mathematician, and astronomer, born in Egypt, in the year 70. He is considered the first astrono-

mer of antiquity, and was the earliest writer who sought to fix the situation of places by their latitude and longitude.

The *Pyramids* are very large structures in Egypt, erected by the ancient Egyptians, many thousand years ago, and still standing. The largest one is now nearly five hundred feet high, above the sands by which it is surrounded, and about seven hundred feet square, at the ground. The stones, of which the pyramids are built, are very large, some of them being four feet in thickness.

Quadrant, the quarter of a circle ; an instrument for taking the altitude or elevation of the heavenly bodies, invented by John Hadley, Esq., and called Hadley's Quadrant.

Quaker, one of a religious sect of professing Christians, called also Friends.

Quhair, (*the King's*,) a beautiful allegory, written by King James I., of Scotland, while he was a prisoner in Windsor Castle, England. It is said to be "the finest poem that had then been produced in the English language, with the exception of Chaucer's."

Rabbi, or *Rabbin*, a doctor in the Jewish law.

Rabbinical, relating to the doctrines of the Rabbins.

Rambler, the title of a work by Dr. Samuel Johnson, author of the English Dictionary.

Ratio, proportion ; the relation which one thing has to another.

Red Sea, an extensive gulf, or arm of the sea, dividing Africa from Asia, and Arabia from Egypt and Abyssinia. It is also called the Arabian Gulf, being connected with that part of the Indian Ocean called the Arabian Sea. It was anciently called the Erythrean Sea, from a king named Erythros ; and as this word, in the Greek language, signifies red, it has, by some, been supposed, that the name Red Sea was given to the gulf from this circumstance. It is about fourteen hundred miles in length, and about two hundred in breadth, at the widest part. The place where the Children of Israel crossed it, (see Exodus xiv.,) was at the northern extremity of the northwestern arm of the gulf.

Reflection, the act of throwing back ; a motion of the rays of light, by which, when they strike upon any body, they are thrown back, as from a mirror.

Reflecting telescope, see *Telescope*.

Reformation, The, that event in the history of the Christian Church, when Protestants separated from the Church of Rome.

Reformation of the calendar, see *Calendar*.

Refraction, a deviation from a straight course. When rays of light pass through a lens, or from one medium to another, as from air into water, and the reverse, instead of continuing on in a straight line, they are said to be refracted, or bent out of their course.

Refracting telescope, see *Telescope*.

Refrangible, capable of being refracted.

Refugee, one who flies to a shelter or protection.

Republican party, a party in England, at the time of the Revolution in that country, A. D. 1688, who were desirous of placing the government in the hands of the people.

The *Restoration*, in English history, the return of King Charles the

Second, and his restoration to the throne, after the Revolution, A. D. 1660.

Revocation of the Edict of Nantz, see *Edict.*

Revolutionary War, American, the war which took place between this Country and England, in 1775, and which resulted in the establishment of the independence of the United States, which, before, had been British Colonies.

Royal Academy, an association established in London, by the royal charter, in the year 1768, for the encouragement of works of art. It consists of forty members, called Royal Academicians, twenty Associates, and six Associate Engravers. It possesses a collection of casts and models from ancient statues, valuable paintings, &c. It has an annual exhibition of works of art, and awards medals for the best paintings, drawings, sculptures, &c.

Royal Library, at Paris, a library commenced by King John of France, with ten volumes. Nine hundred were added by his son, Charles the Fifth, and it has gradually increased to upwards of three hundred thousand printed volumes, and eighty thousand manuscripts, besides a splendid collection of medals, engravings, and other antiquities, and curiosities. Lectures are delivered on the various languages, on antiquities, &c.

Royal Society, (of England,) a celebrated Academy for the promotion of the Arts and Sciences, incorporated April 22, 1663, by King Charles II., under the name of 'The President, Council, and Fellows, of the Royal Society for the Improvement of Natural Philosophy.' It had its origin in the voluntary intercourse of learned men, who thought that their pursuits might be improved and forwarded by the communication of their thoughts and observations to each other, during their leisure hours. Dr. Wilkins, of Wadham College, Oxford, weekly entertained the resident philosophers of that University, at his lodgings, for this feast of reason; and deserves the honor of being considered the founder of the Society, the meetings of which are now held in London, from the middle of November till July, on Thursday evenings, between the hours of eight and nine o'clock. At these meetings, such papers, relative to the various subjects of natural philosophy, and the arts and sciences generally, as are received during the week, from different individuals, are read by the Secretary, and such curiosities as may have been received are also exhibited. The nature of the papers read at the meetings may be known from the following extract from the published declaration of the Society, which states its object to be, to "make faithful records of all the works of Nature or Art, which come within their reach; so that the present, as well as after ages, may be enabled to put a mark on errors which have been strengthened by long prescription; to restore truths that have been neglected; to put those already known to more various uses, and to make the way more passable to what remains unrevealed." Its fellows, or members, are admitted by ballot, after sufficient inquiry being made, as to their pretensions to the honor.

Ruric, the founder of the Russian empire. He was chieftain of a tribe called Varagians, which he united with the Slavi, forming one nation—the Russians. He died A. D. 879.

Saardam, a village, situated a few miles from Amsterdam, in Holland, where there is an extensive shipyard.

Safety lamp, see page 115.

St. Patrick, called the Patron Saint and Apostle of Ireland, was the second bishop of that country. At sixteen years of age, he was seized by pirates, and carried into slavery, in which condition he remained six years. He was then ordained priest, and sent to Ireland, where he labored successfully for sixty years, in the conversion of the inhabitants. He died about A. D. 460. He is supposed to have been a native of Wales, or Cornwall, in England.

St. Peter's, a magnificent church at Rome, the largest in the world, the building of which was commenced A. D. 1506, and completed A. D. 1612.

St. Peter's chair, an expression denoting the office of the Pope, who is said, by Roman Catholics, to be the successor of St. Peter.

Salaheddin, or *Saladin*, a famous Sultan of Egypt, renowned as a warrior and as a legislator. He died A. D. 1193, aged fifty-seven.

Salsolæ, a genus of plants, so called (from *sal*, salt) on account of their saline properties. Salt-wort is a species of this genus.

Sawing, sowing.

Saxon, the language of the ancient Saxon inhabitants of England.

Scholarships, provision made at colleges and other seminaries of learning, by benevolent persons, for the education of scholars who may be unable to defray the expenses of their education.

School of Alexandria, see *Alexandria, School of.*

Scire facias, "cause it to be known," the name given to a judicial writ calling upon the defendant to show cause why execution should not be made out against him, on a judgement which has been rendered. It cannot be issued till a year and a day after the judgement has been given.

Scythian, belonging to Scythia, an ancient nation in the northeastern part of Europe and northern part of Asia, comprehending, generally, modern Russia, Tartary, and Siberia.

Seal Office, an office in London, where the public seals are kept and affixed to instruments.

Sennaar, an extensive country in Africa, lying between Nubia and Abyssinia.

Serf, a slave attached to the soil on which he lives, and transferred with it.

Sextant, the sixth part of a circle; also an instrument like a quadrant, except that its limb only comprehends a sixth part of a circle, while that of the quadrant comprehends the fourth part.

Sheikh, or *Sheick*, the chief of an Arab tribe.

Shenstone, (William,) an eminent English elegiac and pastoral poet, and a miscellaneous writer, who was born in November, 1714, and died February 11, 1763.

Shiraz, a city of Persia, near the Persian Gulf, once a very flourishing and beautiful city, but now rapidly going to decay. Its population is about twenty thousand.

Sibylline oracles. The Sibyl was an ancient prophetess and priestess of Apollo. There were ten celebrated ones, as at Delphi, Cu-

mæ, &c. The one at Cumæ is said to have come to the palace of the Roman Emperor Tarquin the Second, and shown him nine books, containing prophecies, demanding three hundred pieces of gold for them, which Tarquin refused to give. She then burnt three of them, in his presence, and demanded the same sum for the remaining six, which he still refused. She then threw three more into the fire, demanding the same sum for the remaining three, which the King, astonished at her behavior, is said to have given, when the Sibyl disappeared, and was never afterwards seen. These three books were ever after preserved as sacred, and were called the *Sibylline leaves* or verses. These priestesses were consulted as oracles, and were supposed to be able to foretell future events.

Sidrophel, an astrologer or sorcerer, introduced by Butler into his poem called Hudibras.

Sine of an angle, a right line drawn from any point in one side of an angle, perpendicular to the other side.

Sclavonic, or *Slavonic*, belonging, or relating, to Slavonia, or country of the Slavi, a kingdom or province now included in the Austrian empire, and lying between Hungary and Turkey. The dialects of the Slavonic language are spoken throughout the extensive region comprehending European Russia, Poland, Silesia, Bohemia, and Moravia; also, in the countries adjacent to Hungary on the east and south.

Society of Arts, see *Arts, Society of.*

Socrates, the most celebrated philosopher of antiquity. He was born at Athens, where he resided, and instructed a number of illustrious pupils, by his exemplary life, as well as by his doctrines. He was falsely accused of crimes, by his enemies, and condemned to drink hemlock, (which is a deadly poison.) He died about four hundred years before the birth of our Saviour, in the seventieth year of his age.

Sodium, a metal discovered and procured by Sir H. Davy, from soda. It is soft, white, and opaque, and has the lustre and general appearance of silver.

Solon, one of the seven wise men of Greece. He was born at Salamis, and educated at Athens; and afterwards travelled over the greatest part of Greece. On his return to Athens, he was immediately elected Archon, or sovereign legislator, and gave the Athenians a code of laws, which remained in force more than four hundred years. He then resigned his office, and spent ten years in Egypt and other countries, and died in the island of Cyprus, B. C. 558, in the eightieth year of his age.

Sound, a shallow sea, such as may be sounded. *The Sound* of Denmark is the strait between the island of Zealand and the coast of Sweden, leading from the North Sea to the Baltic, where the Danes exact a toll from all merchant ships.

Suez, a maritime city of Egypt, at the head of the western arm of the Red Sea, called the Gulf of Suez. It was once a place of considerable trade and importance; but is now a wretched and insignificant place, in the midst of a desert, and rendered very unhealthy by the adjacent marshes.

Sunnites, those who belong to the most numerous of the sects into which the Mohammedans are divided, called *Sunni*.

Superjacent, lying upon, or over.

Surat, one of the largest and most ancient cities of India, situated about fifteen miles from the Sea of Arabia, and one hundred and seventy-seven miles north of Bombay, on the River Taptee, or Tuptee. The first mercantile establishment of the East-India Company in the Mogul dominions was made here, in the year 1615. Its trade is now inconsiderable, but its population is supposed to amount to six hundred thousand persons.

Swift, (Rev. Jonathan, D. D.,) Dean of St. Patrick's, in Dublin, an illustrious political, satirical, and miscellaneous writer and poet, who was born November 30, 1667, and died in October, 1745, in the seventy-eighth year of his age. He is said to have had the most unbounded influence over the people of Ireland. The collection of his works makes twenty-seven volumes in octavo. Among them are the Tale of a Tub, Gulliver's Travels, and many political essays.

Sylva, wood or forest, the title of a work on forest trees, by John Evelyn, one of the greatest natural philosophers that England ever produced.

Synagogue, a Jewish place of worship.

Syracuse, a maritime city of Sicily, and anciently the capital of that island, founded by a Corinthian colony, about B. C. 736. In its flourishing state, it extended twenty-two and a half English miles in circumference, and contained one million eight hundred thousand inhabitants. Its population is now estimated at only about fifteen thousand.

Tasso, (Torquato,) an illustrious poet, who was born A. D. 1544, and died A. D. 1595, aged fifty-one years. He was the author of 'Jerusalem Delivered,' and many other works, which show him to have been a philosopher, orator, logician, critic, and poet, and excellent in every kind of composition. His life was a continued chain of miseries and wo.

Tehama, desert of, a flat, sandy tract in Arabia, extending along the shore of the Red Sea, from the strait of Bab-el-Mandeb, north.

Telescope, an optical instrument, used for viewing distant objects, as the moon, stars, and other heavenly bodies. There are various kinds of telescopes. Those first made were called *refracting* telescopes, because their magnifying powers depended entirely upon the refraction of the light, in its passage through the several lenses; but as the rays of light were at the same time dispersed, an indistinctness was thrown over the image which such telescopes presented to the eye, which much lessened their value. To remedy this defect, the *reflecting* or *Gregorian* telescope was constructed. This is so called from its having been first proposed by James Gregory, a distinguished optician, though the first was constructed by Sir Isaac Newton. The image of the object seen, is in this produced by reflecting the light from the object. But this not answering the desired purpose, another was invented by Mr. John Dollond, who was born in the year 1706, and died in 1761, as mentioned in this

Volume, page 224. It is called the *achromatic* (or *colorless*) telescope, because it is so constructed, as to present images of objects nearly destitute of the colored border, which is a defect in almost all other telescopes.

Theodolite, an instrument for taking the heights and distances of objects, or for measuring the angles, in surveying land.

Thuringian, a native of Thuringia, the former name of an extensive territory in Germany.

Timbuctoo, or *Tombuctoo*, a town of central Africa, situated about eight miles from the most northerly part of the River Niger, and the emporium of African traffic.

Torricelli, (Evangeliste,) an illustrious mathematician and philosopher of Italy, born A. D. 1608, and died A. D. 1647, in the fortieth year of his age.

Tower. The Tower of London is an ancient edifice, or fortress, on the north bank of the River Thames, and at the extremity of the city. It is supposed to have been erected by William the First, on his Conquest of England, in 1066, but it is probable the Romans previously had a fort on the same spot. The Tower was the royal palace for five hundred years. Within the walls are a church, the old mint, the ordnance office, the record office, the jewel office, where the crown-jewels are kept, several armories, a menagerie, or place for wild beasts, and other buildings, some of which were used as prisons for state criminals, who were executed on the hill called *Tower Hill*.

Treasury, Lords of the, officers to whom are committed the care of the public money in England, like the Secretary of the Treasury in this Country.

Tripolitan, a native of Tripoli, the most easterly of the States of Barbary, in Africa, with a capital of the same name. Tripoli is also the name of a pashalik with a capital of the same name, situated in Syria, on the eastern coast of the Mediterranean, north of Palestine.

Trojan War, a war undertaken by all the states of Greece, to recover Helen, wife of the Spartan King, Menelaus, who had been forcibly carried away, by Paris, son of the King of Troy.

Troy, a celebrated city, (called also Ilium,) situated in the western part of Asia Minor, and on the shores of the Grecian Archipelago. It was besieged by the Greeks, for ten years, and was finally destroyed, about one thousand one hundred and eighty-four years before the birth of our Saviour. See *Homer*, and *Trojan War*.

Tuik, took.

Turkish, relating to the Turks, or to Turkey.

Turks, natives of Turkey, an extensive empire situated in the southeastern part of Europe and western part of Asia, bordering on the Mediterranean and Black Seas, and governed by the Grand Signior, who resides at Constantinople.

Tuscan, belonging, or relating, to Tuscany, a sovereign state of Italy, occupying the northwestern part of the peninsula, between the Mediterranean Sea and the Appenine Mountains. Florence is its capital city.

Uranus, the most ancient of all the heathen deities, called also Coelus, which means, the sky, or heavens.

Usufruct, the temporary use, enjoyment of the profits, without power to alienate.

Vacuous, empty, unfilled.

Venetian, belonging to Venice.

Venice, situated at the head of the Adriatic Sea, was formerly a great republic. The commerce and wealth of the East came to this favored spot. Venice ruled the Mediterranean Sea, and, at one time, seemed almost ready to overpower Europe. It has now almost entirely lost its importance, as a republic ; but the city of Venice remains, and is, next to Rome, the finest of the Italian cities. It is built on seventy little islands in the Adriatic, and, instead of streets, canals pass between the houses, and people visit and do their business by moving in boats and gondolas, instead of walking or riding.

Verbiage, empty writing or discourse.

Vitalian, a leader of the Scythians, who besieged Constantinople in the early part of the sixth century.

Volatile alkali, see *Alkali*.

Volta, (Alessandro,) an Italian philosopher, who made valuable discoveries in electricity.

Vulgar Fractions, common fractions.

Walachia, *Wallachia*, or *Valachia*, a province of the Ottoman or Turkish empire in Europe, north of the River Danube.

Water-frame, a spinning machine, so called from its having been originally moved by water-power. It is also called a throstle.

Weft, or *woof*, in weaving, the threads crossing the warp.

Wes, was.

Wilkins, (John,) Bishop of Chester, a most ingenious and learned English philosopher, who was born A. D. 1614, and died in London, November 19, 1672.

Yemen, the southern province of the Arabian peninsula, the Arabia Felix of the ancients. The word signifies the South.

Zonaras, (John,) one of the Greek historians, who had considerable employments under the emperors of Constantinople, but, wearied with worldly matters, became a monk, and died in the early part of the twelfth century.

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New York January, 1847.